Exhibit B

(Filed Under Seal)

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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

IN RE: CATHODE RAY TUBE (CRT) ANTITRUST LITIGATION	Master File No. CV-07-5944-SC MDL No. 1917
This Document Relates to: ALL INDIRECT PURCHASER ACTIONS	**DECLARATION OF JANET S. NETZ, PH.D., IN SUPPORT OF MOTION OF INDIRECT-PURCHASER PLAINTIFFS FOR CLASS CERTIFICATION** Date: TBD Time: TBD Before: Hon. Charles A. Legge (Ret.) Special Master The Honorable Samuel Conti

REDACTED PER COURT ORDER (D.E. 1512)

I. Qualifications

I, Janet S. Netz, am a founding partner of applEcon, LLC. I have been a tenured Associate Professor of Economics at Purdue University and a Visiting Associate Professor at the University of Michigan. I received a B.A. (1986) from the University of California, Berkeley, *cum laude*, and an M.A. (1990) and Ph.D. (1992) from the University of Michigan, all in the field of economics. My doctoral fields were Industrial Organization, which is the study of firms and markets, and International Trade, which includes the study of firms and markets in a global environment.

Among the courses that I have taught, those that are most closely related to the issues of this case include Industrial Organization at the undergraduate and doctoral level; Antitrust and Regulation at the undergraduate level; and Microeconomic Theory at the undergraduate and master's level. I have guest lectured on the role of an economic expert in an Alternative Dispute Resolution class at the University of Michigan Law School. I have spoken on the role of economists and economics in class action antitrust cases at several American Bar Association conference programs. My research has focused on competitive interactions of firms and strategies firms can use to increase profits. I have published in peer-reviewed, scholarly journals and have presented my research at many conferences and seminars. I provide my academic employment and publication histories in my curriculum vitae, which is attached as Exhibit A.

I have testified by affidavit or declaration as to class certification or class decertification in ten cases and I have been a consulting expert on class certification or decertification in six cases.[1] I have testified in trial or by affidavit or declaration, especially with regard to the determination of the impact of anti-competitive conduct on consumers and quantifying the magnitude of the impact, for over ten years. In addition, I have consulted on numerous antitrust cases. I provide a list of the cases on which I have testified and consulted in my curriculum vitae, which is attached as Exhibit A.

I am compensated for my work on this case at the rate of $450 per hour. My compensation is not dependent on my opinions or the outcome of the case.

II. Assignment

Plaintiffs' counsel have asked me to evaluate the economic effects of Defendants' allegedly illegal conduct. In particular, Plaintiffs' counsel has asked me to evaluate whether Defendants' conduct had common or class-wide impact on the members of the proposed class and whether

[1] The cases for which I testified to class certification issues are *Daniel Gordon v. Microsoft*, No. 00-5994 (Minn. Dist. Ct.); *Friedman et. al. v. Microsoft Corp.*, No. CV-2000-000722 (Ariz. Super. Ct.); *In Re Flash Memory Antitrust Litigation*, No. C-07-0086-SB (Northern Dist. Ct. of California), *In Re Graphics Processing Units Antitrust Litigation*, No. M:07-cv-01826-WHA (Northern Dist. Ct. of California); *In re Photochromic Lens Antitrust Litigation*, No. 8:10-md-02173-JDW-EAJ (Middle Dist. Ct. of Florida); *In Re Reformulated Gasoline (RFG) Antitrust & Patent Litigation*; No. 05-1671 CAS (Central Dist. Ct. of California); *In Re TFT-LCD (Flat Panel) Antitrust Litigation*, No. M:07-cv-01827-SI (Northern Dist. Ct. of California); *Joe Comes and Riley Paint, Inc. v. Microsoft Corp.*, CL 82311 (Iowa Dist. Ct.); *Morelock Enterprises Inc. v. Weyerhaeuser Co.*, No. 04-583-PA (Oregon Dist. Ct.), *Pro-Sys Consultations Ltd. v. Microsoft Corporation*, 2008 BCSC 1263 (Supreme Court of British Columbia).

computation of the damages suffered by the class members as a result of Defendants' alleged conduct is susceptible to common proof on a formulaic basis.

I undertake my analysis on the assumption that liability will be proven. That is, I assume that Plaintiffs will prove that Defendants conspired to jointly set the price of CRT tubes, as Plaintiffs allege.

With respect to the second inquiry in my assignment, I discuss methods of estimating damages – and the feasibility of implementing them – in a way that is susceptible to common proof on a formulaic basis. While I have engaged in sufficient investigation to assure myself that such methods are available and feasibly implemented, I have not, at this stage of the proceedings, conducted a full and complete estimate of damages.

My staff, under my guidance, and I have reviewed numerous materials on which I base my conclusions. This material includes documents and data produced in the discovery process of the case, as well as publicly available documents relating to the CRT industry. The latter includes, but is not limited to, company SEC filings, Annual Reports, press releases, CRT and display industry reports, news and journal articles, white papers and presentations from research firms, and CRT-related websites.

To the best of my ability, I have kept track of the materials reviewed. In Exhibits B and C, I provide a list of all confidential and public documents, respectively, that my staff and I have reviewed to date. I reserve the right to revise my conclusions and opinions as more information comes to light.

III. Summary of Plaintiffs' claims

A. Definition of class and sub-classes

The Plaintiffs allege that the price-fixing conspiracy extends from at least 1 March 1995 through 25 November 2007. The proposed State-Wide Classes are defined by Plaintiffs as:

> All persons and entities in [Indirect-Purchaser State] who, from March 1, 1995 to November 25, 2007, as residents of [Indirect-Purchaser State], purchased Cathode Ray Tubes incorporated in televisions and monitors in [Indirect-Purchaser State] indirectly from any defendant or subsidiary thereof, or any named affiliate or any named co-conspirator, for their own use and not for resale. Specifically excluded from this Class are defendants; the officers, directors, or employees of any defendant; the parent companies and subsidiaries of any defendant; the legal representatives and heirs or assigns of any defendant; and the named affiliates and co-conspirators. Also excluded are any federal, state, or local governmental entities, any judicial officers presiding over this action, members of their immediate families and judicial staffs, and any juror assigned to this action.[2]

[2] 01 October 2012, Memorandum of Points and Authorities in Support of Motion of Indirect-Purchaser Plaintiffs for Class Certification, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter "IPPs Memo in Support of Class Cert."), p. 2.

The indirect purchaser states include: Arizona, California, District of Columbia, Florida, Hawaii, Iowa, Kansas, Maine, Michigan, Minnesota, Mississippi, Nebraska, Nevada, New Mexico, New York, North Carolina, North Dakota, South Dakota, Tennessee, Vermont, West Virginia, and Wisconsin. The applicable class period for Hawaii, Nebraska, and Nevada begins from June 25, 2002, July 20, 2002, and February 4, 1999, respectively.[3]

CRT products are defined as color display tubes (CDTs) which are used in computer monitors, and color picture tubes (CPTs) which are used in TVs. CRT products also include the finished TVs and computer monitors containing CPTs and CDTs, respectively.[4]

The economic analysis that I describe below applies to the nationwide and state classes.[5] Unless expressed otherwise or the context clearly indicates otherwise, I will refer to the class or class members, meaning both the Nationwide Class and Indirect Purchaser State Classes.

B. Membership of the cartel

The CRT cartel was comprised of the nine Defendants (including LP Displays and Thai CRT, which no longer exist) and six companies Plaintiffs seek to add as defendants (two Thomson entities, three Mitsubishi entities, and Videocon).[6] [redacted] CRTs are purchased by manufacturers for use as the display component of televisions and computer monitors.

C. Cartelization of the CRT industry

During the twelve years of the class period,[7] a cartel monopolized the manufacture of CRTs. The cartel's membership included most of the largest CRT manufacturers. Monopolization of CRTs was effected by a variety of mechanisms: the cartel met to fix prices, with top management in regular attendance and the cartel collusively restricted capacity. Either form of conduct alone is sufficient to raise prices, but successful cartels often employ multiple, redundant strategies. In addition to fixing price and restricting output, the CRT cartel fixed market shares among cartel members; allocated customers to cartel members; shared information, such as capacity and output, not ordinarily shared with competitors; and created opportunities for managers of "competing" companies to build trust through socialization.

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[3] IPPs Memo in Support of Class Cert. p. 2.

[4] This excludes certain products that are CRT-based but not in the case (i.e., rear projection products). 11 December 2010, Indirect Purchaser Plaintiffs' Third Consolidated Amended Complaint, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter "Complaint"), ¶¶13-15.

[5] While Plaintiffs seek damages only for the Indirect Purchaser State Classes, the analysis of the existence of common impact and common, formulaic methods for calculating damages are equally applicable to the Nationwide Class.

[6] Using parent companies for the count: Chunghwa, Daewoo/Orion, Hitachi, IRICO, LPD, MTPD, Samsung, Samtel, and Thai CRT. 22 August 2012, Indirect Purchaser Plaintiffs' Notice of Motion and Motion For Leave to Amend Complaint; Memorandum of Points and Authorities in Support Thereof, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter "Proposed Amended Complaint").

[7] The CRT cartel's operations spanned the years 1995 through 2007. The class period begins at least as early as March 1, 1995, and ends no earlier than November 25, 2007. Complaint, p. 1.

[redacted]

[redacted]

In the remainder of this report, I show that the conduct of the cartel had a common impact: it raised the prices of CRTs above the competitive level for all direct purchasers, and this overcharge was passed on to all class members in the form of supra-competitive prices for televisions and computer monitors. Moreover, I show how the impact of the cartel's conduct can be quantified in a formulaic way based on common evidence, for both direct purchasers and class members. I begin with a description of the CRT industry.

IV. The economic questions relevant to class certification

I undertake the analysis of the existence of common impact and the feasibility of measuring the damage on a common, formulaic basis in light of product, firm, and industry characteristics. I assume that the Defendants engaged in the conduct described in the Complaint. Based on my analyses, I conclude that (a) common impact to class members exists, in that they paid higher prices for CRTs than they would have in the absence of a cartel, and (b) damages to the class can be calculated using a common, formulaic method.

A. The cartel had a common impact on indirect purchaser class members

To inform my conclusion regarding whether the cartel had an impact, I begin by examining the characteristics of the industry and the cartel. First, I examine the characteristics of the industry and the cartel to determine whether those economic characteristics support the ability of the cartel to increase prices above competitive levels.[10,11] The relevant characteristics include: the lack of an alternative source of supply of CRT tubes; the existence of barriers to entry; and regular meetings and interactions that allowed the Defendants to exchange information, come to agreements, and monitor cheating. In addition to applying economic principles to the case at hand, I examine the price targets set by the cartel and actual market prices. I find that these prices match very well. Based on these common analyses, conducted using common evidence, I conclude that the cartel had an impact: the cartel increased prices.

Next, I consider the commonality of the impact: did the cartel increase prices to all direct purchasers? I analyze the prices for CRTs to determine whether the prices are related by market forces; that is, is there a structure for CRT prices? If such a price structure exists, then prices for CRTs with different product configurations and sold to different customers would respond in similar ways to a price-fixing conspiracy. I use regression analysis to examine the determinants of CRT prices. I find that over 91% of the variation in prices is determined by common factors.

[10] Throughout this report, I use the term "price increases" and similar terms to mean price increases above their level absent collusion, unless specifically noted otherwise. See the discussion in Section VIII.A.

[11] By competitive price, I mean the price that would have existed had the Defendants behaved independently. I do not refer to the price in a perfectly competitive model.

Then, at most 9% of CRT prices can be determined by individual factors. That is, most of the variation in CRT prices is driven by common factors rather than individual ones, and these common influences on price are susceptible to being estimated using a formula.

I then consider whether the higher price imposed on direct purchasers translates into higher prices to indirect purchasers (class members). The effect of an increase in price at the top of the distribution chain (brought about by the increased prices charged by the cartel) on the price to final consumers at the bottom of the distribution chain is called pass-through. I consider the well-accepted and thoroughly developed economic theory of pass-through, which shows that industry-wide cost increases result in higher product prices. I also examine the documentary evidence and find that market participants, the trade press, and market research firms all acknowledge the generalized impact that a change in CRT tube has on CRT monitor and TV prices. Based on the theoretical analysis and the documentary evidence, I conclude that the higher CRT tube prices imposed on direct purchasers as a consequence of the alleged illegal acts translated into higher CRT monitor and TV prices for indirect purchasers. I conclude that the cartel has a common impact on class members: class members face a higher price for CRT monitors and TVs as a result of the cartel.

In short, I conclude that, if Defendants engaged in the alleged conduct, there is common impact: class members pay a higher price for CRT monitors and TVs because of Defendants' conduct.

B. The damages to class members can be measured on a common, formulaic basis

I then consider whether damages can be estimated using common evidence on a common, formulaic basis. To do so, I first consider several methods that could be used to calculate the overcharge to direct purchasers: a regression analysis of the determinants of CRT prices; a benchmark comparison to a proxy for the competitive outcome; a simulation model of prices; and an analysis of the relationship between market power and prices. After considering the applicability of these methods in light of industry characteristics and data availability, I conclude that each of them can be used to estimate the overcharge to direct purchasers of CRT tubes on a common, formulaic basis.

Next, I turn to considering whether the pass-through rate – the degree to which retail prices increase given the overcharge imposed on direct purchasers of CRT tubes – can be measured on a common, formulaic basis. I review data from a variety of firms that manufacture monitors and TVs from CRT tubes and from firms that distribute CRT tubes and CRT monitors and TVs. Based on the pass-through studies that I am able to conduct at this time, I conclude that the extent to which cost changes imposed by Defendants affect the price paid by class members can be quantified using a common, formulaic method. Thus, the overcharge to direct purchasers is fully passed through to indirect purchasers.

Because the overcharge to direct purchasers and the pass-through rate can be determined on a common, formulaic basis, the damages to class members are quantifiable on a common, formulaic basis.

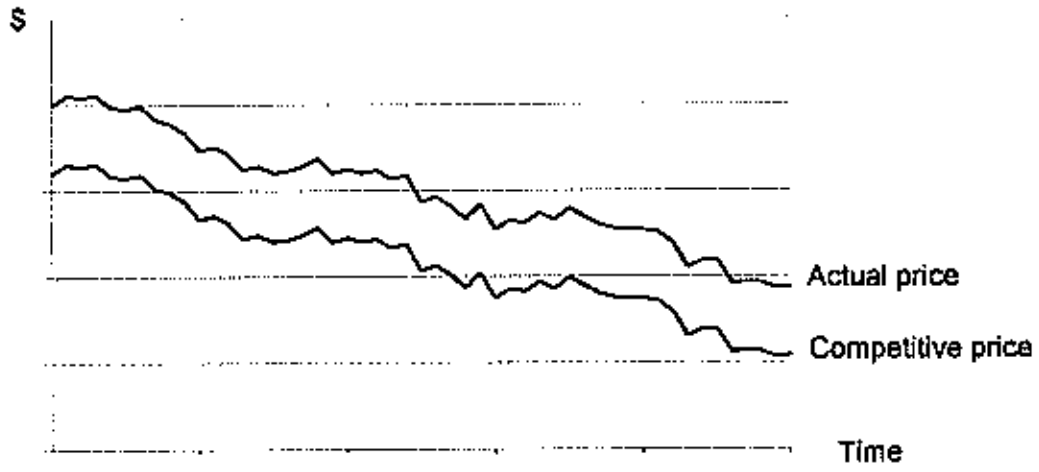
V. The basic economics of cartels

A. Cartel "success" is antitrust harm

A cartel is a group of firms that explicitly coordinates its pricing or output activities. The objective of a cartel is to increase cartel members' prices and profits above the level that would

prevail in the absence of the cartel.[12] Accordingly, I consider a cartel to be "successful" or "effective" if its members are able to charge prices above those that would have prevailed absent the cartel. I call the price that would have prevailed absent the cartel the "competitive price"[13] or the "but-for price". A "successful" cartel, as I use the term, necessarily causes antitrust harm.

Causing price to be above the competitive level is often referred to as "raising" price; this terminology can be confusing, especially when observed prices decline over time. The chart below illustrates hypothetical supracompetitive prices that decline over time:



The line in the chart above labeled "actual price" shows the prices that were actually charged by the cartel; they decline over time.[14] The line labeled "competitive price" shows the prices that would have prevailed absent the cartel. The cartel overcharge is the amount by which the actual price is above the competitive price. When I refer to the cartel "raising price", I mean that the price charged by cartel members is above the competitive price; equivalently, that the cartel imposed an overcharge. As the chart above illustrates, "raising the price above the competitive level" can occur when prices are falling over time: the price "rises" relative to the competitive price, it does not necessarily rise over time.

[12] "In any market, firms have an incentive to coordinate their production and pricing activities to increase their collective and individual profits by restricting market output and raising the market price. An association of firms that explicitly coordinates its pricing or output activities is called a cartel." Carlton, Dennis, and Jeffery M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Addison-Wesley Longman, Inc., p. 122.

[13] The "competitive price" is not to be confused with the equilibrium price in a perfectly competitive market. Most markets are not perfectly competitive even if free of monopolizing conduct such as cartelization; the "competitive price" is therefore not, in general, equal to the equilibrium price in a perfectly competitive market.

[14] The cause of the decline in prices is assumed for the purpose of this discussion to be unrelated to the conduct of the cartel. For the purpose at hand, the reason for the decline is immaterial to the point under discussion. In the actual world, prices may decline over time for many reasons unrelated to cartel conduct; for example, prices may decline over time if costs decline over time.

Similarly, "raising price" does not necessarily result in above-normal profit. In certain circumstances, an industry may be subject to below-normal profitability.[15] In such cases, a cartel may eke out merely normal (or even below-normal) profit. Such a cartel is nonetheless successful if it charges a higher price than would exist absent the cartel: making a dollar of profit at the cartel price is better than earning a dime at the competitive price. A cartel has succeeded if the price it charges is above the competitive price.

B. Cartel incentives: monopolization and cheating

1. Cartel success

If all firms in a market join a cartel, then the cartel can function like a monopolist: when cartel members' conduct is unified, the cartel can control the market price and output like a monopoly, set the monopolist's profit-maximizing price and output, and collect monopoly profits, as long as cartel profits do not attract entry by others.[16] If fewer than all of the firms in a market form a cartel, or if entry into the market occurs, the cartel can still raise price and earn supra-competitive profits, though not as effectively as a cartel that includes all suppliers in a market in which no entry occurs.

To be successful, a cartel must possess market power. To illustrate, consider a hypothetical cartel that includes all suppliers of paper clips. Consumers may be able to avoid paying cartel overcharges for paper clips by switching to substitutes, such as binder clips and staples, if these other products are supplied by firms outside the cartel. In that case, substitution to these other products would prevent the hypothetical cartel from raising the price of paper clips significantly above the competitive level. If the cartel were broadened to include all suppliers of all paper fastening products, the cartel could prevent substitution away from paper clips to other paper fasteners by raising the prices of all paper fastening products. Only if the cartel controls all sufficiently good substitutes and consumers are willing to pay supra-competitive prices can a cartel raise price above the competitive level. In sum, cartel success requires market power.

Market power is the ability to profitably raise price by restricting output below the competitive level.[17] I illustrate this definition with the aid of the following diagram:

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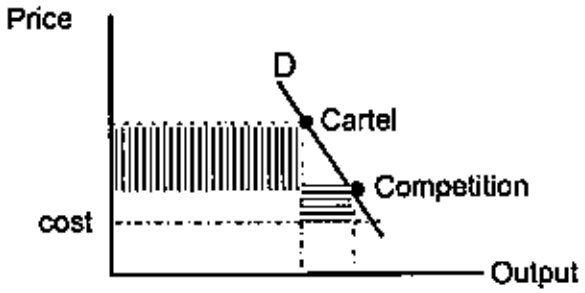
[15] Profit is "normal" if firms earn a rate of return equal to their cost of capital. Long-term sub-normal profitability can occur if industry capacity is substantially in excess of current and probable future demands, and rigidities retard the reallocation of capital to more profitable uses. Below, I show that these conditions prevailed in the CRT industry during the proposed class period: see Section VIII.A.1.c)(2)(a).

[16] "A cartel that includes all firms in a market is in effect a monopoly, and the member firms share the monopoly profits... If a few large firms make most of the sales in a market, and if they coordinate their activities, they can raise price without involving all the other (smaller) firms in the market. For example, Spain and Italy, which controlled 80% of the world's production of mercury, formed a successful cartel that did not formally involve five other producers." Carlton, Dennis, and Jeffery M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Addison-Wesley Longman, Inc., pp. 122, 135.

[17] Areeda, Phillip E., Hovenkamp, Herbert, and John L. Solow, 1995, Antitrust Law: An Analysis of Antitrust Principles and Their Application, Volume IIA, Little, Brown & Company: Boston, ¶501, p. 85.



In this diagram, price is on the vertical axis and output (quantity) is on the horizontal axis. The sloping line labeled "D" is the market demand curve; it shows, for each price, the amount of output that will be purchased by buyers. In general, buyers will purchase more output at lower prices than at higher prices; equivalently, sellers can extract a higher price when they supply less output. The dashed line labeled "cost" is the cost of producing additional output when output is near the competitive level. The point labeled "Competition" shows the competitive price and the quantity demanded at the competitive price.

If a cartel restricts output below the competitive level, it can charge a higher price because the demand curve is downward sloping; the cartel-restricted combination of price and output is the point on the demand curve labeled "Cartel". The increase in cartel profit due to the restriction of output is equal to the area shaded vertically (the increase in profit due to charging a higher price) minus the area shaded horizontally (the reduction in profit due to lower sales).

I show that the CRT cartel possessed significant market power in Section VIII.A.1.

a) Restricting output causes price to rise

Because the market demand curve determines price given output (or output given price), there are two fundamental mechanisms by which a cartel can cause price to rise. The first is to simply set prices above the competitive level; this implicitly causes output to be below the competitive level because buyers purchase less output at higher prices (as determined by the demand curve). The second mechanism is to restrict output below the competitive level, which implicitly causes price to be above the competitive level, again as determined by the demand curve. The two mechanisms are equivalent: each causes price to rise.

[redacted]

b) Output can be "restricted" even when it is growing over time

The phrase "restricting output" is subject to the same confusion as the phrase "raising price". Both "raising" and "restricting" in the context of a cartel refer to comparisons with the competitive level, not to changes over time: output may be "restricted" (below the competitive level) even though it is increasing over time, just as price can be "raised" (above the competitive level) even when it is falling over time. A graph illustrating "restricted" output would look

[redacted]

similar to the graph in the previous V.B.1 section illustrating "raised" price: it would show two lines increasing over time; the higher of the two lines would represent the competitive level of output, and the lower line would be below the actual level ("restricted"), despite the fact that the actual output increases over time.

c) Anticompetitive harm exceeds overcharges

The harm to consumers caused by cartel overcharges is greater than simply the overcharges themselves. As illustrated in the graph above, consumers purchase fewer units of a good at the cartel price than the lower, competitive price. For ease of exposition, suppose that 100 consumers would have purchased one CRT product each at the competitive price, and only 90 consumers bought CRT products at the higher cartel price. Overcharge damages are the harm caused by the cartel to the 90 consumers that bought CRT products at the cartel price. The 10 consumers that did not purchase CRT products at the cartel price were harmed by the cartel, too, and this harm is not included in overcharge damages. They were harmed because they would have preferred to buy a CRT product at the competitive price, but were induced by the cartel overcharge to spend their money on other goods instead.

2. Cartel cheating

Even when a cartel includes all the firms in a market, it differs from a monopoly in that it is comprised of individual firms. Each member of a cartel has two fundamental incentives. One incentive is to cooperate with the cartel's policies, because unity of action offers the possibility of sharing in monopoly profits. The other incentive is to "cheat" on the cartel agreement, because cheating increases the profits the firm earns. By cheating, a firm gains sales and higher profits in the near term, while enjoying the protection of the cartel from unbridled price competition.[19] These two incentives pull cartel members in opposite directions – to price high and to price low. However, unless cheating is ubiquitous, cartel cheaters' prices are still above the competitive level. This is because the cartel members that cooperate with cartel policy provide a "price umbrella": buyers must pay the supra-competitive cartel target price if they don't buy from cheaters, so cheaters can sell at prices above the competitive level.[20]

a) Mechanisms to address cheating

Successful cartels develop ways to address members' incentive to cheat.[21] Cartel members' incentive to cheat is constrained to some extent by their incentive to perpetuate the cartel and share in the fruits of monopolization.[22] Cartel members may monitor each other for compliance

[19] "[A]lthough it is in the cartel's best interest for every firm to restrict output [raise price], it is in [each cartel member's] best interest for [every other cartel member] to restrict output [raise price]." Carlton, Dennis, and Jeffery M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Addison-Wesley Longman, Inc., p. 126.

[20] I provide a more formal explanation of why cheaters' prices are above the competitive level in Section VIII.B.2.

[21] "Sophisticated cartel organizations are also able to develop multipronged strategies to monitor one another to deter cheating." Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, p. 43.

[22] "Following George Stigler (1964), many economists assume that incentive problems undermine attempts by firms to collude to raise prices and restrict output. But the potential profits from collusion can create a powerful incentive as well." Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, p. 43.

with cartel policy regarding pricing and output. Cartels may establish mechanisms for punishing cheaters, such as trigger prices: if a cartel member charges a price below the trigger price, the cartel authorizes a price war to punish the cheater. Excess capacity may be held in order to make credible the threat of a price war. However, price wars and holding excess capacity are expensive for those doling out the punishment as well as for those receiving punishment.[23] Empirical studies find that cartels tend to avoid such expensive strategies by developing methods to monitor each other, encourage cooperation, and physically prevent cheating.[24]

One efficient mechanism for limiting cheating is to impose restrictions in capacity, such as temporary shut-downs of capacity. Such capacity restrictions are generally easily monitored and commit cartel members to output restrictions, depriving them of opportunities to cheat by limiting their ability to fill orders. Output restrictions, as noted above, cause prices to be above competitive levels.

b) Cheating is not necessarily fatal to cartel success

While some cartels break up due to cheating, many cartels continue to operate in the face of cheating.[25] Moreover, cartels can survive episodes of extended price wars to re-establish supra-competitive prices after the price war has subsided.[26]

c) Whether a cartel succeeds is an empirical question unresolvable by theory or industry characteristics

Whether a cartel will succeed in increasing price above the competitive level is determined by which of the two fundamental incentives dominates, the incentive to monopolize or the incentive to cheat. While economic theory tells us that cartel members are subject to both incentives,

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[23] Moreover, there is a contrary view of the role of excess capacity in cartel members' incentives: while holding excess capacity makes the threat of a price war credible, it may also raise the incentive to cheat by reducing marginal cost and thereby raising the profitability of additional sales. One theoretical study finds "support for the *conventional view* that periods of low demand lead, through the emergence of excess capacity, to a breakdown of collusive pricing… a large body of empirical evidence supports this view." Staiger, Robert W., and Frank A. Wolak, 1992, Collusive Pricing with Capacity Constraints in the Presence of Demand Uncertainty, The RAND Journal of Economics, Vol. 23(2), 203-220, p. 203.

[24] "Although the evidence shows that cartels use a range of punishment mechanisms to deter cheating, including both 'price wars' and side payments, successful cartels do not simply rely on ex post punishments. Instead, they invest in monitoring mechanisms, such as joint sales agencies or regular reporting to one another or third parties. Cartels much prefer to develop the means to monitor each other's behavior in order to deter or physically prevent cheating, rather than resorting to expensive punishments such as price wars." "Successful cartels develop mechanisms for sharing information, making decisions, and manipulating incentives through self-imposed carrots and sticks." Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, pp. 44 and 86.

[25] "Cartels break up occasionally because of cheating or lack of effective monitoring, but the biggest challenges cartels face are entry and adjustment of the collusive agreement in response to changing economic conditions." Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, p. 43.

[26] "The very successful bromine cartel lasted from 1885 to 1902. During its reign, the average price of bromine was about 25 percent higher than the average in the years before the cartel's formation. There were only three periods of extended price wars over the cartel's roughly 20 year life span… The pool fell apart and the price of potassium bromide (the major bromine product) plunged 45 percent in two months." Carlton, Dennis W., and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Pearson Addison Wesley, p. 140.

economic theory alone cannot tell us which incentive prevails in a particular situation; whether a cartel succeeds is an empirical question. Certain industry characteristics tend to be correlated with the presence of cartels or with cartel success, but successful cartels exist in industries with a wide variety of characteristics.[27] For example, it is often said that cartels are more likely to be found in concentrated industries; yet successful cartels have operated in quite unconcentrated industries.[28] Whether a cartel has succeeded is therefore an empirical question that cannot be resolved by examining the characteristics of an industry.

3. Vertically integrated firms profit from upstream cartels

[redacted] Vertically integrated firms profit from a CRT cartel as do their unintegrated counterparts. For unintegrated firms, the benefit of price-fixing is straightforward: these firms profit by selling tubes at cartel prices rather than lower, competitive prices. Vertically integrated companies also profit by raising the price of CRTs. Economists have studied cartels with vertically integrated firms using sophisticated theoretical models and empirical methods. A recent paper in a prominent scholarly economics journal studied incentives for collusion and vertical integration by firms in upstream markets (exactly the situation in the case at hand), and found that vertical integration facilitates collusion.[30] In the model of an industry that is initially unintegrated, at least one firm will vertically integrate in equilibrium, but integration may stop well before all firms are vertically integrated, which helps explain "why a limited degree of vertical merger may be profitable in industries aiming to collude. This is interesting since many industries seem to have the feature that vertically integrated firms compete with separated ones."[31] The equilibrium in this model is similar to the structure of the CRT industry, with its mix of vertically-integrated firms and

[27] "[M]any economists assume that incentive problems undermine attempts by firms to collude to raise prices and restrict output. But the potential profits from collusion can create a powerful incentive as well. Theory cannot tell us, a priori, which effect will dominate: whether or when cartels succeed is thus an empirical question." "There is considerable variety in the type of products and industries where collusion appears." Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, pp. 43 and 57.

[28] "[I]ndustry concentration makes collusion easier, both by simplifying the coordination issues and by increasing firms' gains from collusion. But successful cartels have operated in a wide variety of industries by developing organizations that can overcome these challenges. There are in fact many successful cartels in quite unconcentrated industries, but they almost always rely on industry associations." Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, p. 44.

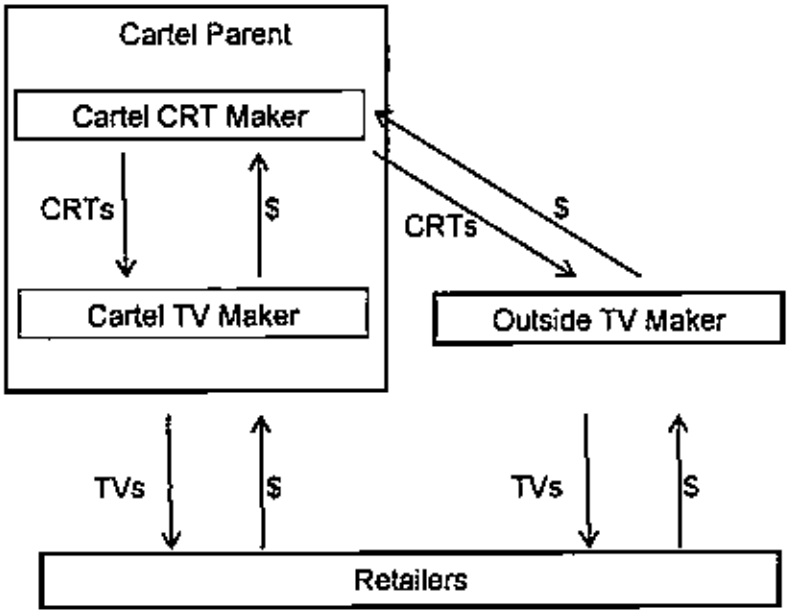
[redacted]

[30] "In a vertically unintegrated industry, a [single] vertical merger [resulting in a mix of integrated and unintegrated firms, as in the CRT industry] facilitates collusion." Nocke, Volker, and Lucy White, September 2007, Do Vertical Mergers Facilitate Upstream Collusion?, The American Economic Review, Vol. 97(4), 1321-1339, pp. 1329, 1330, 1332.

[31] Nocke, Volker, and Lucy White, September 2007, Do Vertical Mergers Facilitate Upstream Collusion?, The American Economic Review, Vol. 97(4), 1321-1339, p. 1332.

unintegrated firms. Other economic models are also consistent with a cartel comprised of vertically-integrated and unintegrated firms.[32]

For ease of exposition, I explain the sources of gain to a vertically-integrated firm using a stylized example. "Cartel Parent" is a CRT cartel member that owns a CRT manufacturing subsidiary called "Cartel CRT Maker". Cartel CRT Maker sells CRTs to two TV manufacturers, "Cartel TV Maker", a sister company owned by Cartel Parent, and "Outside TV Maker", a firm unaffiliated with cartel members. The TV manufacturers engage in horizontal competition in the sale of TVs to retailers. The following diagram illustrates the relationships:



When the cartel raises the price of CRTs, the profitability of the vertically integrated firm is enhanced in at least two ways. First, Cartel Parent receives a supra-competitive price from non-cartel TV manufacturers (Outside TV Maker in the diagram above): this is the same as the mechanism by which unintegrated cartel members profit. The elevated CRT price charged internally (by Cartel CRT Maker to Cartel TV Maker) does not benefit the parent company directly; the money simply goes from one pocket of the parent company to another.

[32] Riordan and Salop (1995), for example, explain how instances in which the downstream division of a vertically integrated firm purchases inputs from other input makers – as occurs in the present case – can help monitor the behavior of the upstream manufacturers. "Vertical mergers might be able to increase the likelihood of tacit or express coordinated conduct by facilitating the exchange of pricing and other competitively sensitive information among the competing input suppliers. [footnote: The 1984 DOJ Merger Guidelines offer a related theory of how vertical mergers can facilitate information exchange among competitors. See 1984 DOJ Merger Guidelines §4.221, *supra* note 5, at 20,566-57...] Assuming that the integrated firm does not satisfy all of its input requirements, but rather continues to purchase part of its requirements from other input suppliers, the downstream division will receive price quotes and competitive information from rival input producers. The downstream division can transfer this information to its upstream division." Riordan, Michael H., and Steven C. Salop, 1995, Evaluating Vertical Mergers: A Post-Chicago Approach, Antitrust Law Journal, Vol. 63, pp. 513-568.

The second way the vertically integrated firm benefits from the cartel's elevation of the CRT price is by allowing its TV subsidiary (Cartel TV Maker) to charge a higher price for TVs. When the cartel raises the price of CRTs, the cost of producing TVs rises for unintegrated downstream firms (such as Outside TV Maker in the diagram). Outside TV Maker responds to the cost increase by increasing the prices of its CRT TVs. Cartel TV Maker is a horizontal competitor of Outside TV Maker, so when Outside TV Maker raises its price, Cartel TV Maker raises its television price, too, and earns supracompetitive profit. Consumers face higher CRT TV prices whether they purchase from Cartel TV Maker or Outside TV Maker. Therefore, the cartel price for tubes increases the profit of the vertically-integrated cartel member (Cartel Parent). Vertically integrated CRT-TV or CRT-monitor manufacturers increase profits by joining a cartel in CRTs.

C. Examples of successful cartels

Despite the incentive to cheat and all of the other the difficulties faced by cartels, many do succeed. The success of some legal cartels, such as OPEC and the De Beers diamond cartel, is well known.[33] Legal cartels face many of the same incentive problems, such as the incentive to cheat, as illegal cartels. Economists have, of course, written a great deal about cartels. One study of 51 cartels found that 19 of them were successful.[34] A study of 1,120 cartels found a mean overcharge of 15.14% among international cartels after 1973.[35]

Effective cartels of vertically integrated intermediate goods producers (like the Defendants' cartel) are not only, as I showed above, possible in theory: one study of collusion in industries with vertical integration found that "[m]any famous cases of collusion have involved intermediate goods industries. Further, a significant fraction of those cases involved industries where one or more firms were vertically integrated."[36] In a recent example of a cartel of intermediate goods manufacturers, automotive suppliers recently pleaded guilty to fixing the prices of products sold to automobile manufacturers, and paid large fines consistent with significant overcharges.[37]

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[33] OPEC quadrupled the price of oil when it cartelized that industry. See Carlton, Dennis W., and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Person Addison Wesley, pp. 132-133.

[34] "Eckbo (1976) studied 51 formal international cartel organizations in 18 industries, with the earliest agreement in 1918 and the latest in 1964. He defined a cartel as successful if it raised the price at least three times the marginal production cost of the member with the highest cost. Only 19 cartels (37 percent) were successful by this criterion. One of them, the iodine cartel, lasted 61 years. The remaining successful cartels had formal agreements that lasted from 2 to 18 years, with a median lifetime of 5 years and a mean of 6.6 years. Only 5 of the 19 lasted 10 years or longer." Carlton, Dennis, and Jeffery M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Addison-Wesley Longman, Inc., p. 132. Eckbo, Paul L., 1976, The Future of World Oil, Cambridge, MA: Ballinger.

[35] Boyer, Marcel, and Rachidi Kotchoni, March 2011, The Econometrics of Cartel Overcharges, Scientific Series, Table 6, p. 43.

[36] The authors cite five economic studies of cartels which are, like Defendants, comprised of intermediate goods producers. Nocke, Volker and Lucy White, September 2007, Do Vertical Mergers Facilitate Upstream Collusion?, The American Economic Review, Vol. 97(4), 1321-1339, p. 1321. Another paper by a pair of prominent economists analyzes three real-world cartels of vertically integrated intermediate goods producers (none of them duplicated in the previous list of five examples of cartels in intermediate goods). Hart, Oliver, and Jean Tirole, April 1990, Vertical Integration and Market Foreclosure, Massachusetts Institute of Technology, pp. 61-71.

[37] United States Department of Justice, 30 January 2012, Yazaki Corp., Denso Corp., and Four Yazaki Executives Agree to Plead Guilty to Automobile Parts Price-Fixing and Bid-Rigging Conspiracies, http://www.justice.gov/atr/public/press_releases/2012/279734.htm, accessed 20 September 2012.

A cartel of LCD panel manufacturers was recently found guilty by a U.S. jury of price fixing. LCD panels are flat panel displays used in televisions and computer monitors. The jury found that the cartel succeeded in imposing overcharges of at least $500 million.[38] The LCD industry cartel is instructive for the case at hand in several ways. Both the CRT and LCD cartels operated in large manufacturing industries with economies of scale and large capital requirements. Both industries include a mix of vertically-integrated suppliers that manufacture both displays and the televisions that contain them, and un-integrated suppliers of displays to television and monitor manufacturers. Five members of the LCD cartel were also members of the CRT cartel: Samsung, Toshiba, Hitachi, LG, and Chunghwa Picture Tubes.[39]

VI. The CRT industry

The cathode ray tube (CRT) is a mature display technology widely used in televisions and computer monitors in the late-1990s and the first decade of the 21st century. CRTs operate by shining an electron beam onto a phosphor-coated panel, causing the phosphors to glow, emitting red, green, and blue light to compose a picture. The CRTs relevant to the present case range in size from 14" to 42".

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[38] "Following an eight-week trial, a federal jury in San Francisco today convicted the largest Taiwan liquid crystal display (LCD) producer [AU Optronics], its Houston-based subsidiary and their two former top executives for their participation in a five-year conspiracy to fix the prices of thin-film transistor-liquid crystal display (TFT-LCD) panels sold worldwide, the Department of Justice announced. The jury also found that the ill-gotten gain to the conspirators as a result of the fixed sales in the United States was at least $500 million." United States Department of Justice, 13 March 2012, Taiwan-Based AU Optronics Corporation, Its Houston-Based Subsidiary and Former Top Executives Convicted For Role in LCD Price-Fixing Conspiracy, http://www.justice.gov/atr/public/press_releases/2012/281032.htm, accessed 20 September 2012

[39] See, e.g.,

- Samsung was found by the European Commission and South Korea's Fair Trade Commission to have participated in the LCD cartel. See Europa, 08 December 2010, Antitrust: Commission fines six LCD panel producers €648 million for price fixing cartel, http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1685, accessed 10 September 2012, and Musil, Steven, 31 October 2011, South Korea fines six LCD makers for price fixing, CNET News, http://news.cnet.com/8301-1001_3-20128181-92/south-korea-fines-six-lcd-makers-for-price-fixing/, accessed 10 September 2012.
- Toshiba was found guilty by a U.S. jury of conspiring to raise LCD prices, and liable for a fine of $87 million. Musil, Steven, 03 July 2012, Jury finds Toshiba guilty of LCD price-fixing, CNET News, http://news.cnet.com/8301-1023_3-57466274-93/jury-finds-toshiba-guilty-of-lcd-price-fixing/, accessed 10 September 2012.
- Hitachi admitted that it fixed the prices of LCD panels and agreed to pay a fine of $31 million. United States Department of Justice, 10 March 2009, Hitachi Displays Agrees to Plead Guilty and Pay $31 Million Fine for Participating in LCD Price-Fixing Conspiracy, http://www.justice.gov/printf/PrintOut2.jsp, accessed 10 September 2012.
- LG admitted that it fixed the prices of TFT-LCD panels and agreed to pay $400 million in fines. United States Department of Justice, 12 November 2008, LG, Sharp, Chunghwa Agree to Plead Guilty, Pay Total of $585 Million in Fines for Participating in LCD price-Fixing Conspiracies, http://www.justice.gov/atr/public/press_releases/2008/239349.htm, accessed 10 September 2012.
- Chunghwa Picture Tubes admitted that it fixed the prices of TFT-LCD panels and agreed to pay a $65 million fine. *Ibid.*

A. CRT product description

1. Components of CRTs

CRTs operate by shining a beam of electrons on a screen that is coated with material that glows when the electron beam strikes it. The primary components of a CRT are a large glass bulb containing an electron gun and a device near the rear of the bulb that aims the electron gun. The bulb is comprised of two elements. The front of the bulb is called the panel; this is the screen the viewer observes. It is coated on the inside with phosphors that glow when the electron beam strikes them, emitting red, green, or blue light. The remainder of the bulb is called the funnel, because of its funnel shape. The electron gun is housed inside the neck of the funnel. Around the outside of the neck is the deflection yoke. The deflection yoke, sometimes called a deflection coil, aims the electron beam. It scans the electron beam back and forth and up and down across the screen.[40] The CRT creates a picture by turning the electron gun on and off as the deflection yoke moves the beam across the screen, thereby exciting (illuminating) the appropriate color phosphors in the proper locations to create the full color picture. The "mask" is an additional component inside the bulb, very close to the inside surface of the panel. Its purpose is to absorb stray electrons to ensure that electrons strike only the phosphors that are supposed to be illuminated.

2. Product differentiation

CRTs are differentiated products. The primary dimensions of differentiation are the application, size, shape, finish, and mask type. Additional differentiation comes from different resolutions and the use of various coatings.

[redacted]

[redacted]

[redacted]

[redacted]

[33] 2012, What is the Dot Pitch of a Computer Monitor, PC Tech Guide, http://www.pctechguide.com/crt-monitors/what-is-the-dot-pitch-of-a-computer-monitor, accessed 13 March 2012.

[34] TCO and MPRII, frequently referenced in meeting note discussions about CDT prices, are safety standards promulgated by Sweden. PCTechGuide.Com, Undated, TCO Monitor Standards, http://www.pctechguide.com/crt-monitors/tco-monitor-standards, accessed 03 August 2012, p. 0115.

In addition to the types of product differentiation just described, there are other differentiating factors among CRTs. While the factors just described generally allowed end product differentiation, there are other attributes – e.g., subtle differences in the curvature of the tube where it meets the bezel of the TV or different electrical requirements – that are crucial to end product manufacturers.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3. Production facilities

CRT manufacturing is a capital-intensive process characterized by economies of scale. Viable CPT factories should produce at least 1.0 million tubes per year.[77] [redacted]

[redacted]

[77] See, e.g.,

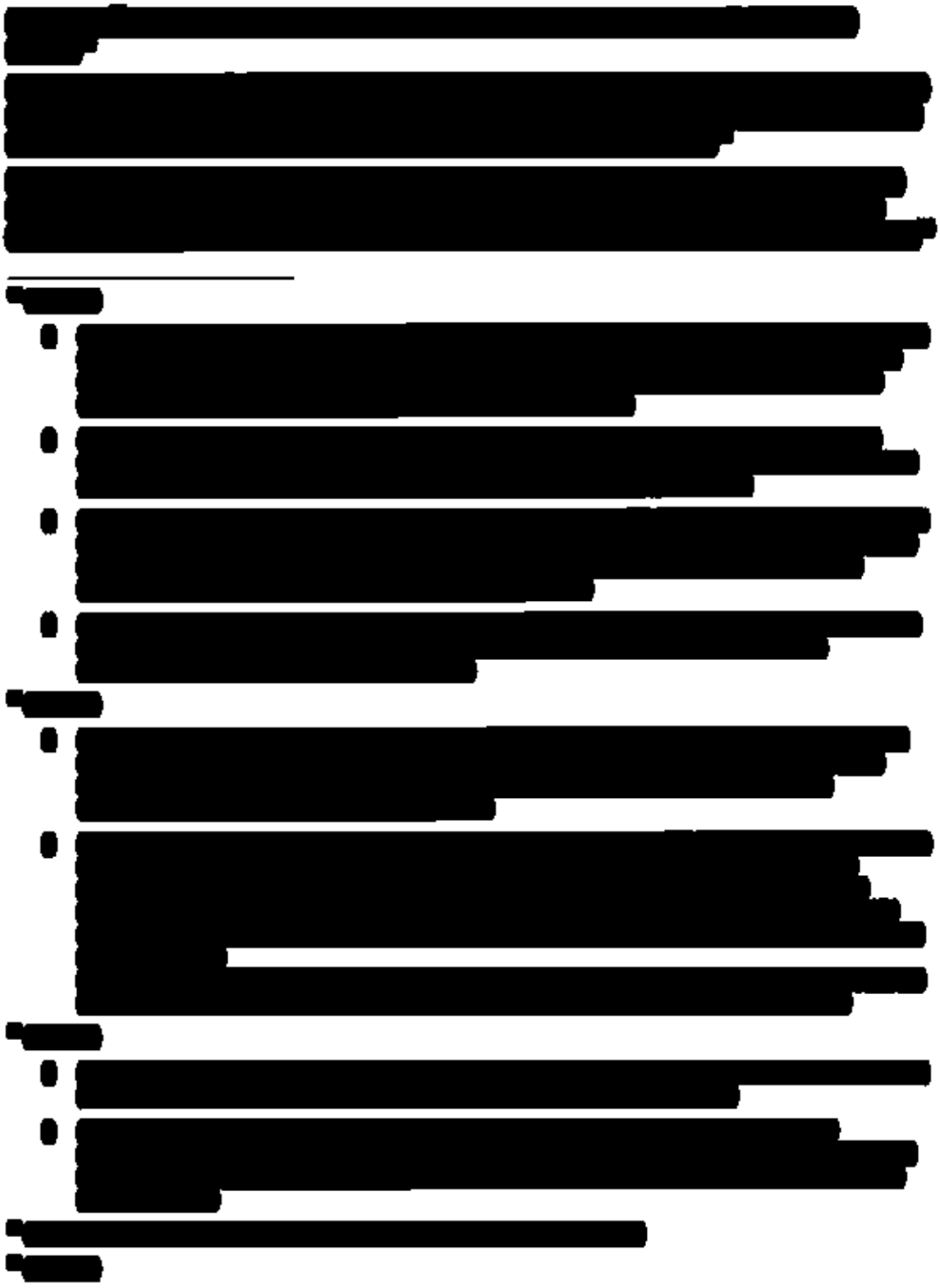
- Sony and LG each built plants planned to produce 1 million units per year. Telecompaper, 20 July 1994, Sony Electronics to Invest in Cathode Ray Tube Plant, http://www.telecompaper.com/news/sony-electronics-to-invest-in-cathode-ray-tube-plant, accessed 22 March 2012 at 1. and Telecompaper, 06 September 1995, LG Electronics to Invest in CRT Plant, http://www.telecompaper.com/news/lg-electronics-to-invest-in-crt-plant, accessed 22 March 2012.
- One author asserts the minimum efficient scale for a CRT plant was 1.5 million units per year. Kenney, Martin, Undated, The Shifting Value Chain: The Television Industry in North America, http://heal.ucdavis.edu/faculty/webpages/kenney/articles_files/The%20Shifting%20Value%20Chain:%20The%20Television%20Industry%20in%20North%20America.pdf, accessed 19 April 2012, p. 105. This document appears to have been written no later than 8/1/03.

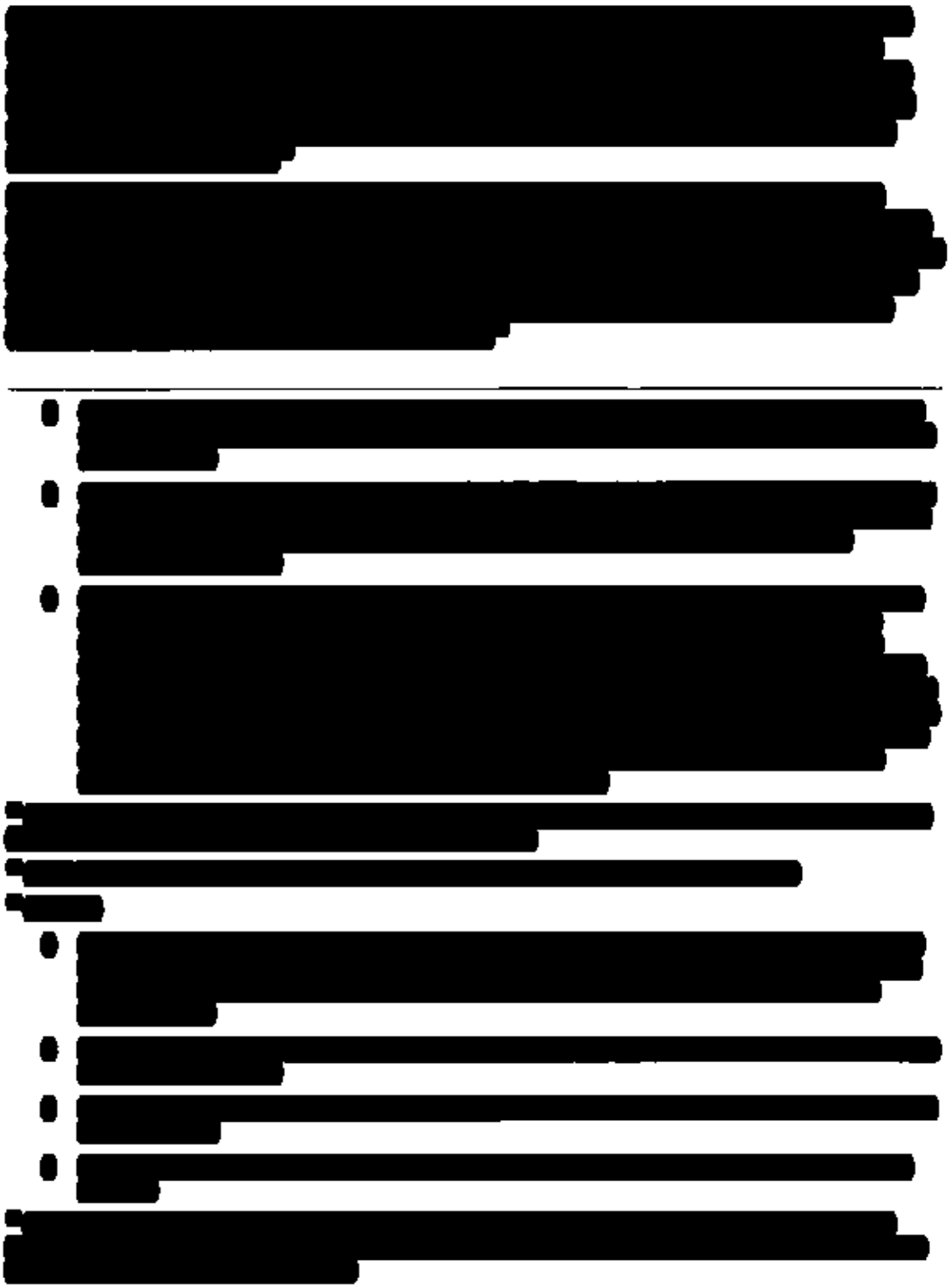
[redacted] CRT manufacturing facilities that make larger tubes generally cost more.[redacted]

[redacted]

- An LG plant in Korea, for the production of 24"-32" CPTs beginning in 1996, cost $125 million and was expected to produce 1 million CPTs per year. Telecompaper, 06 September 1995, LG Electronics to Invest in CRT Plant, http://www.telecompaper.com/news/lg-electronics-to-invest-in-crt-plant, accessed 22 March 2012.
- A Sony plant for 15" and 17" CDT with a capacity of 1 million units per year cost $50 million. Telecompaper, 20 July 1994, Sony Electronics to Invest in Cathode Ray Tube Plant, http://www.telecompaper.com/news/sony-electronics-to-invest-in-cathode-ray-tube-plant, accessed 22 March 2012 at 1.
- In the late 1980s a large screen (25" or more) CRT manufacturing facility generally cost between $200 and $300 million. Kenney, Martin, Undated, The Shifting Value Chain: The Television Industry in North America, http://hed.ucdavis.edu/faculty/webpages/kenney/articles_files/The%20Shifting%20Value%20Chain:%20The%20Television%20Industry%20in%20North%20America.pdf, accessed 19 April 2012, p.105.
- [redacted]

[redacted] Kenney, Martin, Undated, The Shifting Value Chain: The Television Industry in North America, http://hed.ucdavis.edu/faculty/webpages/kenney/articles_files/The%20Shifting%20Value%20Chain:%20The%20Television%20Industry%20in%20North%20America.pdf, accessed 19 April 2012, pp. 104-105.





[redacted]

The Herfindahl-Hirschman Index (HHI) is [redacted]

widely used in academia as well as in antitrust legal and economic analysis to measure the degree of concentration.[95] The HHI is based on the distribution of market shares across firms. Lower HHI values indicate a less concentrated market and, hence, more competitive conditions for market participants. According to the 2010 Horizontal Merger Guidelines, the U.S. Department of Justice (DOJ) considers markets with HHIs below 1500 to be "unconcentrated", between 1500-2500 "moderately concentrated", and above 2500 "highly concentrated."[96]

[redacted]

2. Excess capacity

Throughout the relevant period, CRT manufacturing capacity exceeded quantity demanded at the (cartelized) market prices. I first examine CDT manufacturing capacity and demand for CDT monitors over time. Then I turn to CPT production capacity and output.

a) CDT

[redacted]

[95] The Herfindahl-Hirschman Index (HHI) is calculated by summing the squares of the market shares of all participants in the relevant market. In the case of a pure monopoly, the Herfindahl takes the value of 10,000 (100 squared). In the case of perfect competition (in which no single firm has a large market share), the index will tend toward zero. The U.S. Department of Justice uses Herfindahl indexes as one of the tools to assess competitive conditions when deciding whether to challenge a proposed merger. U.S. Department of Justice and Federal Trade Commission, 19 August 2010, 2010 Horizontal Merger Guidelines.

[96] Department of Justice and Federal Trade Commission, 18 August 2010, 2010 Horizontal Merger Guidelines at Section 5.3 Market Concentration.

[redacted]

[redacted]

[135] See Appendix A for evidence underlying this section.

[redacted]

1. **Direct purchasers**

CRT manufacturers sell to two types of direct purchasers: CRT distributors (firms that distribute CRTs to others that incorporate the CRTs into CRT products) and product manufacturers (firms that incorporate CRTs into CRT products).

a) CRT Distributors

[redacted]

b) Product Manufacturers

Product manufacturers obtain inputs, including CRTs, and assemble them into computer monitors and TVs. During the manufacturing process for computer monitors and TVs, the CRT itself is not modified, but is combined with other inputs to assemble the monitor or TV. Product manufacturers operate under a variety of business models; however, these firms all perform the same basic function—they manufacture monitors and TVs using CRTs. Listed below are descriptions of the various business models employed by product manufacturers.

- Original Equipment Manufacturers (OEMs) sell finished products under their own brand name. An OEM may be responsible for all the design and manufacturing of the finished

[187] Some product manufactures, such as Dell, also sell directly to class members.

[redacted]

CRT product, but also may contract some, or even all, engineering and manufacturing to contract manufacturers (CMs).[110]

- Contract Manufacturers (CM) make components or finished CRT products for other suppliers of CRT products; these products are sold under the name of the customer ordering the product. There are two types of CRT contract manufacturers, Electronics Manufacturing Services (EMSs) and Original Design Manufacturers (ODMs).[111]
  - EMS providers manufacture components and CRT products for their customers, but do not own the IP for the product or its design. EMSs may also provide additional services such as product design or supply chain management.
  - ODMs design and manufacture CRT products to be sold under their customers' brand name.[112] Unlike an EMS, an ODM generally owns or licenses the IP for the product and its design,[113] but in some cases, ODMs design products according to customer specifications.[114] ODMs also may perform all of the design work, offering products that are customized only by adding the customer's brand name prior to sale.[115] ODMs

[110] Even if assembly of the CRT product is carried out by a CM, the OEM may still negotiate directly with the CRT manufacturers for the terms and conditions on which CRTs will be delivered to the CMs.

[111] "The distinction between ODMs and EMSs is diminishing as EMS providers acquire design capability. However, ODMs tend to specialize in only a few products where EMSs are usually engaged in a number of vertical product markets. 10 November 2005, An Interview with iSuppli's Jeffery Wu - ODM vs. EMS, what happens next?, EMSNow, http://www.emsnow.com/npps/story.cfm?ID=15416, accessed 18 June 2008, p. 1.

[112] ". . .an ODM is a company that manufactures products of its own designs, which are then sold under an OEM's brand name." Weber, Austin, 01 February 2003, Outsourcing's Alphabet Soup, Assembly Magazine, http://www.assemblymag.com/copyright/9411390b7d5e9010VgnVCM100000f932a8c0____?view=print, accessed 18 June 2008, p. 1.

[113] See, e.g.,

- ZDNet, 2007, ZDNet Definition for: Contract Manufacturer, http://dictionary.zdnet.com/definition/contract+manufacturer.html, accessed 17 June 2008, p. 1.
- "An ODM performs all the functions traditionally associated with EMS firms, in addition to actually designing products based on their own intellectual property." Weber, Austin, 01 February 2003, Outsourcing's Alphabet Soup, Assembly Magazine, http://www.assemblymag.com/copyright/9411390b7d5e9010VgnVCM100000f932a8c0____?view=print, accessed 18 June 2008, p. 1.

[114] "In the 'Design It' strategy, the OEM involves the ODM in the product design stage to different degrees, depending on the OEM's resource constraints and long-term R&D planning." 10 November 2005, An Interview with iSuppli's Jeffery Wu - ODM vs EMS, what happens next?, EMSNow, http://www.emsnow.com/npps/story.cfm?ID=15416, accessed 18 June 2008, p. 1.

[115] See, e.g.,

- "In the 'Go Shopping' strategy, the OEM purchases the ODM's fully designed and ready-made products and changes minor features such as label or casing to ensure time to market." 10 November 2005, An Interview with iSuppli's Jeffery Wu - ODM vs EMS, what happens next?, EMSNow, http://www.emsnow.com/npps/story.cfm?ID=15416, accessed 18 June 2008, p. 1.
- "Typically, ODMs determine what products to build and the OEM purchases the products ready-made. Weber, Austin, 01 February 2003, Outsourcing's Alphabet Soup, Assembly Magazine, http://www.assemblymag.com/copyright/9411390b7d5e9010VgnVCM100000f932a8c0____?view=print, accessed 18 June 2008, p. 1.

may manufacture products that are sold under many different brand names.[116] In addition, some ODMs may also market products under their own brand name.[117] ODMs may ship finished products directly to distributors or retailers, bypassing the OEM whose name appears on the product.

- Systems Integrators (SIs) operate very similarly to OEMs, but differ in that they make unbranded or "white-box" computer systems, including monitors. It does not appear that SIs or systems builders make TVs.

2. Indirect Purchasers

Product manufacturers sell CRT products either directly to retailers or to distributors that subsequently resell the CRT products to retailers. These retailers and distributors are indirect purchasers of CRT products; that is, they are not purchasing directly from the CRT manufacturers.

a) Product Distributors

Finished CRT products can be shipped to retail markets through independent distributors. These distributors are responsible for maintaining product inventory and preparing it for shipment. Distributors usually ship products to retailers that, in turn, resell to end customers; however, distributors sometimes drop-ship products directly to end customers who purchase through a retailer.

b) Retailers

Retailers sell finished CRT products to end consumers. These retailers include "big box" electronics retailers, specialty retailers, on-line merchants, and direct sales from OEMs to consumers. There are two general types of retail stores: brick-and-mortar stores (e.g., Best Buy, Radio Shack, Staples, Circuit City, Target, and Wal-Mart) and online retailers (e.g., Amazon.com, Buy.com, Dell.com, hp.com, Newegg, PC Mall).[118]

3. Final consumers (class members)

- "Now the outsourcing decision is getting complex because of growing demand for original design manufacturers (ODMs). ODMs not only build a product, but also design it for an OEM. The ODM owns the intellectual property or they license it." Carbone, Jim, 16 January 2003, ODMs offer design expertise; quicker time to market, http://www.purchasing.com/index.ASP?layout=articlePrint&articleID=CA269147&article_prefix=CA&article_id=269147, accessed 01 February 2008, p. 1.

[116] "In many cases, the ODM will design and build products, such as VCRs or televisions, and sell the products to multiple OEMs. The OEMs then market the products under their own brand names." Carbone, Jim, 16 January 2003, ODMs offer design expertise, quicker time to market, Purchasing, http://www.purchasing.com/index.asp?layout=articlePrint&articleID=CA269147&article_prefix=CA&article_id=269147, accessed 01 January 2008, p. 1.

[117] BenQ, a CRT finished product manufacturer, employs both the ODM and OEM business model. 10 November 2005, An Interview with iSuppli's Jeffery Wu - ODM vs EMS, what happens next?, EMSNow, http://www.emsnow.com/npps/story.cfm?ID=15416, accessed 18 June 2008, p. 1.

[118] Generally, brick-and-mortar stores also sell some products online. In contrast, online retailers only sell online.

End-customers purchase CRT products for their own use and do not resell them. End-customers are indirect purchasers that typically purchase CRT monitors and TVs from retailers; however, in some circumstances they purchase CRT products directly from product manufacturers. In the latter scenario, end-customers are still indirect purchasers of CRTs since the product manufacturer is the entity that purchases CRTs and resells CRT products to the end-customers.

VII. Proof of anticompetitive conduct is common to all class members

The anticompetitive conduct alleged by Plaintiffs consists of the Defendants' price-fixing behavior: fixing prices, restricting capacity, allocating customers, and sharing sensitive information. Proving liability is common to all class members because it is related exclusively to actions taken by the Defendants. The evidence of Defendants' conduct will be found in Defendants' documents, such as the cartel meeting notes, and business records, such as sales prices and quantities. No information about putative class members is necessary to demonstrate that Defendants engaged in anticompetitive conduct. Proof that the Defendants engaged in illegal conduct is therefore common to all class members.

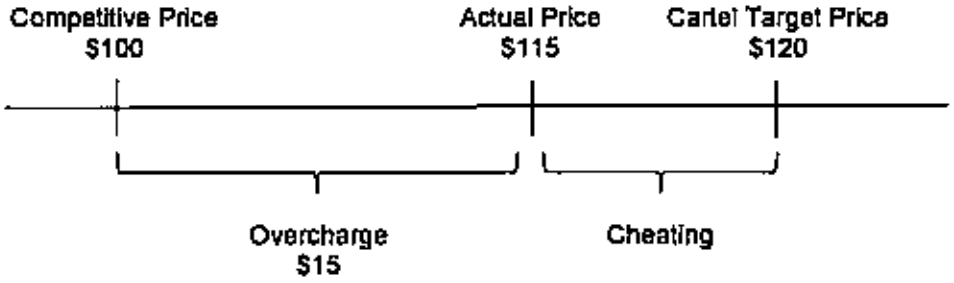
VIII. The conspiracy caused antitrust harm to all class members

[redacted]

A. The cartel was successful at raising price

In this section of my report, I assess the evidence that the CRT cartel successfully raised prices above the competitive level. Such an assessment must recognize the fact that the competitive price (although estimable) is unobservable: because the cartel fixed prices and restricted output, the competitive price (which is what the price would have been in the absence of the cartel) never existed. The cartel overcharge, too, is unobservable, because it is the difference between the actual (observed) price and the competitive (unobserved) price.

To illustrate the information available for the assessment of the cartel's success, suppose that the competitive price of a good is $100, that the members of a cartel agree to a target price of $120, but all cartel members cheat on the agreement and charge $115:



Despite the presence of cheating, the cartel illustrated above has succeeded in raising price $15 above the competitive level ($15 overcharge): even a leaky bucket can carry water. However, the data available to the researcher (and the Court) include the cartel target price (which is discoverable from cartel documents) and the actual price (which may be observed in firms' sales records), but not the competitive price. Estimating the competitive price is ordinarily done as a matter of course in the calculation of damages in price-fixing cases. I describe several methods common to all class members that are suitable for estimation of overcharge damages (and the competitive price of CRTs) in Section IX.C.

[redacted]

1. The CRT cartel possessed market power

To raise price above the competitive level a cartel must possess market power.[119] I begin my demonstration that the cartel raised prices of CRTs by showing that the cartel meets this

[119] See Section V.B.1.

necessary condition. However, when, as here, there is compelling evidence that a cartel actually did raise price, logic does not require the demonstration of a necessary condition: accomplishing a goal is sufficient to show that conditions necessary to accomplish the goal were satisfied. [redacted]

a) The cartel restricted capacity to raise price

A cartel possesses market power if it can raise price by restricting cartel output.[120] [redacted] Cartel members thereby evidenced their belief that the cartel had market power, for without it, their on-going attempt to raise price by restricting capacity would have been irrational. Antitrust authorities recognize that conduct that would be irrational in the absence of market power is evidence of the possession of market power.[122] It might be plausible that cartel members were mistaken in their belief that they had market power, if the cartel had tried to raise prices by restricting capacity and failed one or two times or for a short time period, but it is improbable that the cartel attempted the impossible over and over again for years without giving up. Cartel members were the leaders of a large industry, and should be presumed to know, after repeated attempts, whether they had succeeded in raising price by restricting cartel output. Given the on-going conduct, they must have believed they succeeded. The cartel's repeated efforts to raise price by restricting capacity are therefore consistent with the possession of market power by the cartel.

b) The cartel had a dominant market share

Identifying a market and computing market shares is an indirect means of assessing market power.[123,124] The relevant antitrust market includes all products sufficiently substitutable with CRTs that a hypothetical monopolist over products in the market could set CRT prices above the

[120] Recall that market power is the ability to raise price by restricting output. Areeda, Phillip E., Hovenkamp, Herbert, and John L. Solow, 1995, Antitrust Law: An Analysis of Antitrust Principles and Their Application, Volume IIA, Little, Brown & Company: Boston, ¶501, p. 85.

Moreover, "restricting output" means that the cartel held output below the competitive level; "restricting output" does not necessarily mean that output decreases over time. See Section V.B.1.b).

[redacted]

[122] "Some conduct benefits actors only if it supports supracompetitive prices. Because such conduct would be irrational for the perfectly competitive firm, its occurrence indicates that the defendant has (or believes it has) some degree of market power. The power can be that of an organized cartel, or of oligopolists managing to coordinate their prices at supracompetitive levels, or of a market's sole or dominant occupant." Areeda, Phillip E., Hovenkamp, Herbert, and John L. Solow, 1995, Antitrust Law: An Analysis of Antitrust Principles and Their Application, Volume IIA, Little, Brown & Company: Boston, ¶524a, p. 133.

[123] Areeda, Phillip E., Hovenkamp, Herbert, and John L. Solow, 1995, Antitrust Law: An Analysis of Antitrust Principles and Their Application, Volume IIA, Little, Brown & Company: Boston, ¶532a, p. 160 and 2010 Merger Guidelines (if not explicit in the guidelines, find a speech by Shapiro that DOJ agrees defining a relevant market is a means to an end). U.S. Department of Justice and Federal Trade Commission, 19 August 2010, 2010 Horizontal Merger Guidelines.

[124] This means of assessing market power is "indirect" in the sense that market power is inferred from market share. Direct evidence of market power is evidence that prices were above the competitive level, as in the cartel's elevation of CRT prices by restricting capacity described in Section VIII.A.2.e).

CRTs that a hypothetical monopolist over products in the market could set CRT prices above the competitive level by a small but significant amount for a non-transitory period of time.[125] Inference of market power from market shares can be sensitive to market definition issues: if a market is defined too narrowly, market shares may give a false indication of market power.[126]

In this report, I do not reach any conclusions regarding the boundaries of the relevant antitrust market. Rather, I examine the shares of CRTs supplied by the CRT cartel, and the shares of all displays supplied by both the CRT cartel and the LCD cartel.

(1) The CRT cartel dominated the supply of CRTs

[redacted] I therefore conclude that buyers had few competitively-supplied CRTs available as alternatives to cartel-supplied CRTs.

(2) There were few competitively supplied alternatives to CRT cartel products

Functional alternatives to CRTs are LCD panels, plasma display panels, and projection tubes, as I explained above.

During much of the class period, the product that was perhaps most substitutable with CRTs was TFT-LCD panels. The supply of LCD panels was dominated by a cartel that was found by two U.S. juries to have been guilty of monopolization and to have charged supra-competitive prices for LCD panels.[127] [redacted]

[125] This is according to the Department of Justice's "Hypothetical Monopolist Test", sometimes called the "SSNIP (small but significant and non-transitory increase in price) Test". U.S. Department of Justice and Federal Trade Commission, 19 August 2010, 2010 Horizontal Merger Guidelines, pp. 8-13. By this method, a relevant antitrust market is the smallest set of products over which a hypothetical monopolist, if one existed, could profitably set price above the competitive level.

[126] If a cartel's market share is calculated using a too-narrowly defined market, the total size of the market, which is the denominator in the market share calculation, is understated, causing the cartel's market share to be overstated.

[127] See, *e.g.*,

- United States Department of Justice, 12 November 2008, LG, Sharp, Chunghwa Agree to Plead Guilty, Pay Total of $585 Million in Fines for Participating in LCD price-Fixing Conspiracies, http://www.justice.gov/atr/public/press_releases/2008/239349.htm, accessed 10 September 2012.
- United States Department of Justice, 10 March 2009, Hitachi Displays Agrees to Plead Guilty and Pay $31 Million Fine for Participating in LCD Price-Fixing Conspiracy, http://www.justice.gov/printf/PrintOut2.jsp, accessed 10 September 2012.
- United States Department of Justice, 13 March 2012, Taiwan-Based AU Optronics Corporation, Its Houston-Based Subsidiary and Former Top Executives Convicted For Role in LCD Price-Fixing Conspiracy, http://www.justice.gov/atr/public/press_releases/2012/281032.htm, accessed 20 September 2012.
- Musil, Steven, 03 July 2012, Jury finds Toshiba guilty of LCD price-fixing, CNET News, http://news.cnet.com/8301-1023_3-57466274-93/jury-finds-toshiba-guilty-of-lcd-price-fixing/, accessed 10 September 2012.

[redacted] Direct purchasers of displays therefore had few competitively-priced alternatives to cartelized CRTs.

c) Entry did not constrain the cartel's market power

I discuss entry and entry conditions in the CRT industry as part of my analysis of the effectiveness of the CRT cartel. Entry and entry conditions are relevant to this analysis because cartel success in the long run requires that the cartel be sheltered from the threat of competition from entrants. Accordingly, I seek to identify entry that reduces the cartel's overcharge.

I define "meaningful entry" to be entry by a non-cartel member that increases industry-wide CRT capacity. The introduction of incremental capacity that is not controlled by the cartel induces increased industry output, and therefore reduces price.[130] If an entrant simply acquires a cartel member's capacity and joins the cartel itself, entry is unlikely to have any significant effect on price, because it does not raise industry capacity, and does not affect the cartel's share of the industry's capacity. The cartel attempts to impose the monopolist's profit-maximizing price on the market; the monopoly price does not change when the identities of cartel members change.

In the remainder of this section, I show that there was essentially no meaningful entry in the CRT industry during the class period, and that entry was discouraged by chronic excess capacity in the CRT industry.

(1) Essentially no meaningful entry in the CRT industry

[redacted]

[128] The LCD cartel included ten defendants (AUO, CMO, CPT, EIDC, HannStar, Hitachi, LGD, Samsung, Sharp, and Toshiba) and ten co-conspirators (Fujitsu, Hydis, Innolux, LG Electronics, Mitsubishi, NEC, Panasonic, S-LCD, Sony, and TPO).

[129] See, e.g.,

- [redacted]
- [redacted]

[130] As I explained above, restricting output causes price to rise. See Section VIII.A.1.a). Similarly, increases in output cause price to fall.

[redacted]

[redacted]

(2) Entry was discouraged by excess capacity of sunk capital

(a) Excess capacity induces cutthroat competition

It cannot be inferred from the absence of entry that the cartel was unsuccessful. While a cartelized industry may attract entry if cartel prices are high enough to permit above-normal profit, supra-competitive prices are not necessarily that high. As I explained above at Section V.A, in certain circumstances, an industry may be subject to below-normal profitability. When these circumstances are present, a cartel may price above the competitive level without attracting entry. Such circumstances are described by Areeda, Hovenkamp, and Solow:

> When demand for a product declines, competition drives price below full costs, including a competitive return to capital; producers will continue to earn less than a competitive return until the excess capacity is withdrawn... Barriers to mobility prolong and magnify the losses; competition may become "ruinous."... Until it wears out, plant or equipment will continue in operation so long as price exceeds variable costs because some return on investment is better than nothing. Thus, price can fall and remain well below full costs for an extended period before capacities are reduced enough to restore profitable operations.[135]

[132] 22 August 2012, Indirect Purchaser Plaintiffs' Notice of Motion and Motion For Leave to Amend Complaint; Memorandum of Points and Authorities in Support Thereof, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter "Fourth Consolidated Amended Complaint"), ¶¶102-105.

[redacted]

[133] Areeda, Phillip E., Hovenkamp, Herbert, and John L. Solow. 1995, Antitrust Law: An Analysis of Antitrust Principles and Their Application, Volume IIA, Little, Brown & Company: Boston, p. 50.

[redacted] When excess capacity causes producers to earn less than a competitive return on their investments, potential entrants will not make the large investments necessary to participate in the CRT industry.[136]

Scherer and Ross, in a classic Industrial Organization textbook, call the phenomenon described by Areeda, Hovenkamp, and Solow the "sick industry problem", and state conditions necessary for the problem to arise:

> The cutthroat competition issue has two principal branches. One pertains to industries with chronic excess capacity because superior substitutes have appeared on the scene... the case of the secularly declining or "sick" industry. There are two chief prerequisites: capacity substantially in excess of current and probable future demands and rigidities that retard the reallocation of capital and/or labor toward growing industries. Then unless there is some artificial restraint such as ... tightly knit cartel agreements, competition is likely to drive prices down to levels that yield investors much less than a normal return on their capital. ... When firms' cost structures include a high proportion of fixed costs, this profitless existence can continue for years or even (as in railroading and coal mining) for decades, since producers find it preferable to continue operation and cover at least their ... variable costs than to shut down.[137]

I have already shown that the CRT industry suffered from chronic excess capacity throughout the class period, and that CRT manufacturing equipment cannot be used in other industries: see Sections VI.B.2VI.C.2 and VI.B.3. The CRT industry therefore satisfied the two conditions necessary for the "sick industry problem". Under such conditions, entry is not to be expected.[138]

Assessments of entry conditions made in the ordinary course of business are consistent with the existence of the "sick industry problem". [redacted]

[136] A standard finance textbook gives two equivalent decision rules for firms' investments, one of which is to accept investments that offer rates of return in excess of their opportunity costs of capital, also known as above-normal returns. Brealey, Richard A., and Stewart C. Myers, 2000, Principles of Corporate Finance, Sixth Edition, McGraw-Hill College, p. 19.

[137] Scherer, F.M., and David Ross, 1990, Industrial Market Structure and Economic Performance, Third Edition, Houghton Mifflin Company: Boston, p. 294.

[138] "Entry is not to be expected when established firms are losing money, anticipating a market decline, or carrying large amounts of excess capacity. Nor is entry assured into a market earning only the competitive rate of return." Areeda, Phillip E., Hovenkamp, Herbert, and John L. Solow, 1995, Antitrust Law: An Analysis of Antitrust Principles and Their Application, Volume IIA, Little, Brown & Company: Boston, p. 50.

[redacted]

I described the flexibility of CRT productive capital to produce multiple models above in Section VI.B.2. The implication of this flexibility for an entrant is that incumbents can respond to entry by switching some of their capacity to produce CRTs in direct competition with whatever models an entrant decides to produce, making it difficult for an entrant to find a profitable niche.

[redacted]

When the excess supply of CRT productive capital was at its worst, the price of CRT plant and equipment would have been low,[142] reducing the investment necessary to enter, and thereby inducing entry.

(b) Holding excess capacity can deter entry by credibly threatening a price war

Economists have shown that the presence of excess sunk capital can deter entry, even though incumbents set prices above the competitive level. While prices may currently be high enough to make entry attractive, the presence of excess capacity makes known to potential entrants that incumbents have the ability to respond quickly and decisively with a price war if significant entry is attempted. When there is excess capacity, then, incumbents can impose overcharges, sheltered from competition by entrants.[143]

(c) Entry was risky and significant lead time was required before investments were profitable

[redacted]

[142] "In dying industries, the value of capital is permanently less than replacement cost." Carlton, Dennis, and Jeffery M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Addison-Wesley Longman, Inc., p. 249, footnote 4.

[143] Bulow, Jeremy, Geanakoplos, John, et al., March 1985, Holding Idle Capacity to Deter Entry, The Economic Journal, Vol. 95, 179-182.

[redacted]

(d) Even incumbents made only limited investments in capacity

Investment conditions faced by an incumbent and investment conditions facing an entrant are not necessarily equal. An incumbent evaluates the profitability of *incremental* investments, given the existence of the capital it already has in place. Incumbents' capital includes, in addition to physical capital such as plants and production lines, all of the intangible capital an incumbent has acquired by participating in the market, such as brand capital (including its trademarks and reputation for quality), intellectual capital (such as patents), and human capital embodied in its employees (such as training and personal connections with customers and suppliers, and, in some cases, with "competitors"). Because incumbents possess this capital and potential entrants do not, investment may be economic for an incumbent but not for an entrant. For example, given that it already has a plant and a production line, an incumbent may find that it is profitable to invest in incremental capital to convert its production line from the production of round CRTs to the production of flat CRTs; however, such incremental investment does not necessarily mean that investment in a new plant and a new production line is economic for a potential entrant.

[redacted]

[redacted]

[19] Entry might require building a plant even if incumbents have excess capacity, because incumbents might prefer to hold a surplus plant rather than sell it to an entrant, if by selling it they weaken the cartel.

[redacted]

[redacted] The reluctance of incumbents to invest in the CRT industry is consistent with industry conditions that sheltered the CRT cartel from competition from entrants.

(3) Conclusions regarding entry conditions

Competition from entrants presented no significant challenge to the power of the CRT cartel to impose overcharges on direct purchasers. There was very little entry, and the little that occurred was after the collapse of demand for CRTs in developed countries using cannibalized capacity or in league with the cartel, or both.

The absence of significant entry does not indicate the absence of cartel overcharges; chronic excess capacity in the industry accounts for the dearth of entry, and the implications of chronic excess capacity, accord well with industry conditions.

The fact that CRT prices were low enough to deter entry does not mean, however, that prices were at the competitive level. As I explained above, competitive prices are the prices that would have prevailed in the absence of the cartel; because of the existence of the cartel, competitive prices did not exist and hence were not observed. In a "sick industry", competitive prices may be low enough that firms would have earned below-normal returns on their investment, absent the cartel. [redacted]

d) Conclusions regarding market power

[redacted]

2. The CRT cartel engaged in the practices of successful cartels

Economists have identified a number of operating practices common to successful cartels. According to a widely used Industrial Organization economics textbook, these include[151]

- Fix more than just price,
- Divide the market,
- Fix market shares,
- Use most-favored-nation clauses and meeting-competition clauses, and
- Establish trigger prices.

Fixing more than just price (such as fixing market shares or assigning customers to suppliers) affords cartel members multiple opportunities to detect non-compliance with the cartel agreement. Fixing capacity is a readily-verifiable means of placing limits on cartel members' ability to cheat. Cheating can be discouraged by cartel members granting their customers most-favored customer clauses and meeting-competition clauses, which promise customers they will receive at least as low a price as that charged all other customers. Such terms reduce the incentive to cheat by requiring that discounts not be given opportunistically to capture incremental customers while continuing to charge higher prices to other customers, but must be given to all customers.

Two prominent cartel scholars found that other practices of successful cartels include[152]

- Develop a hierarchy that includes both top-level executives and working-level members,
- Build trust,
- Employ multi-pronged strategies, and
- Learn from experience.

Next, I compare the practices of the CRT cartel to the practices proven to have been successful for other cartels.

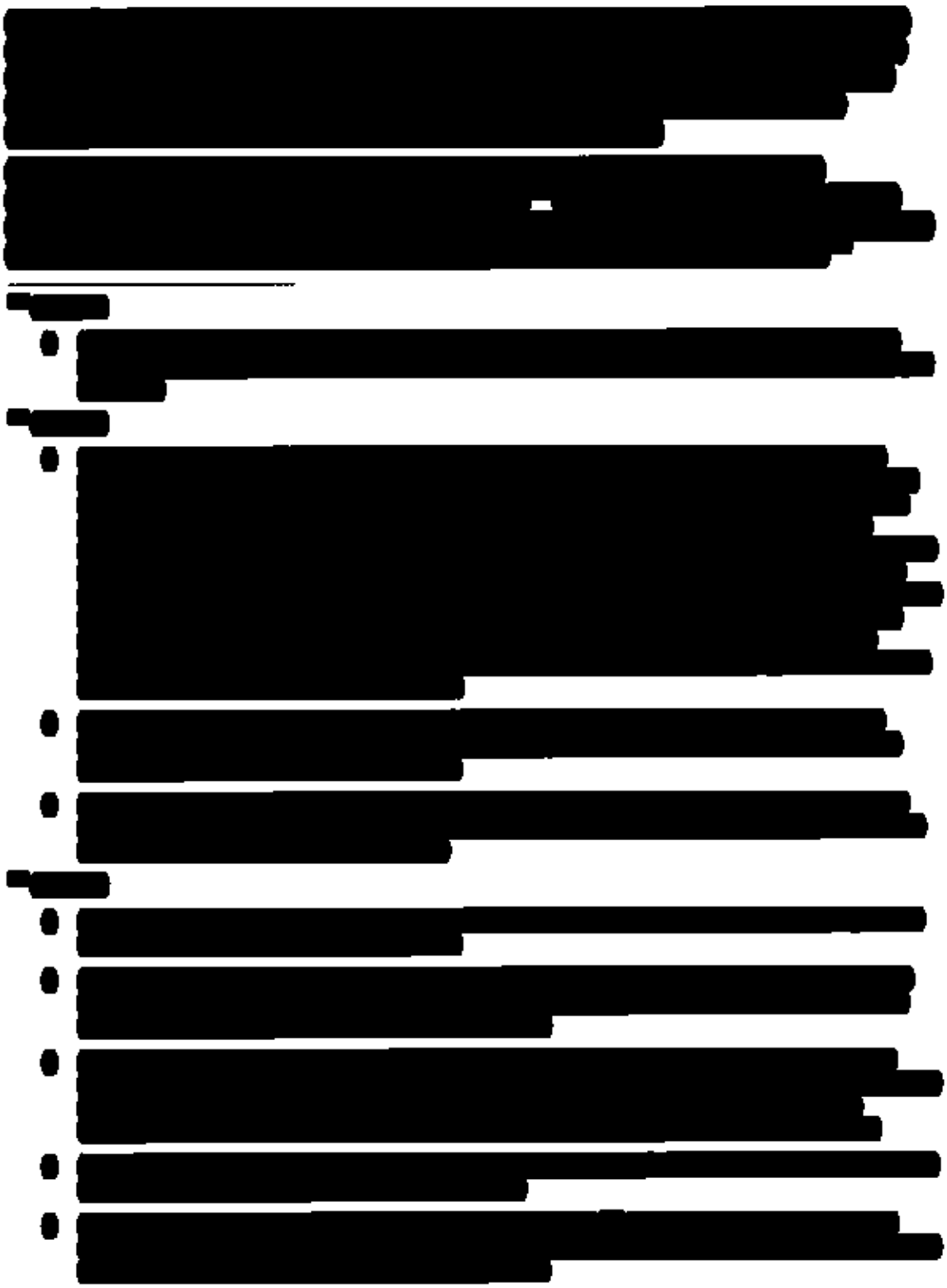
a) The cartel established a hierarchy of meetings

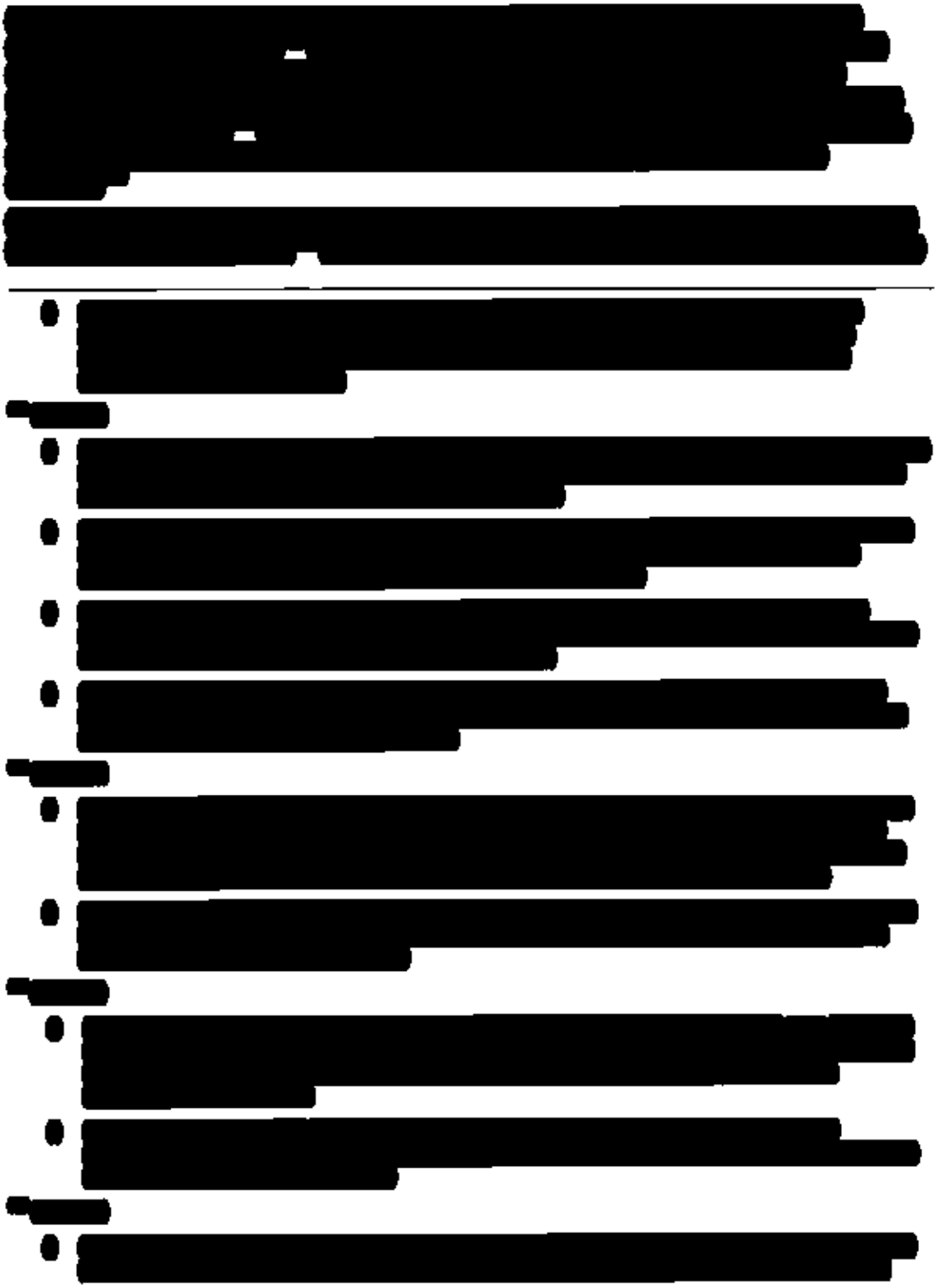
[redacted]

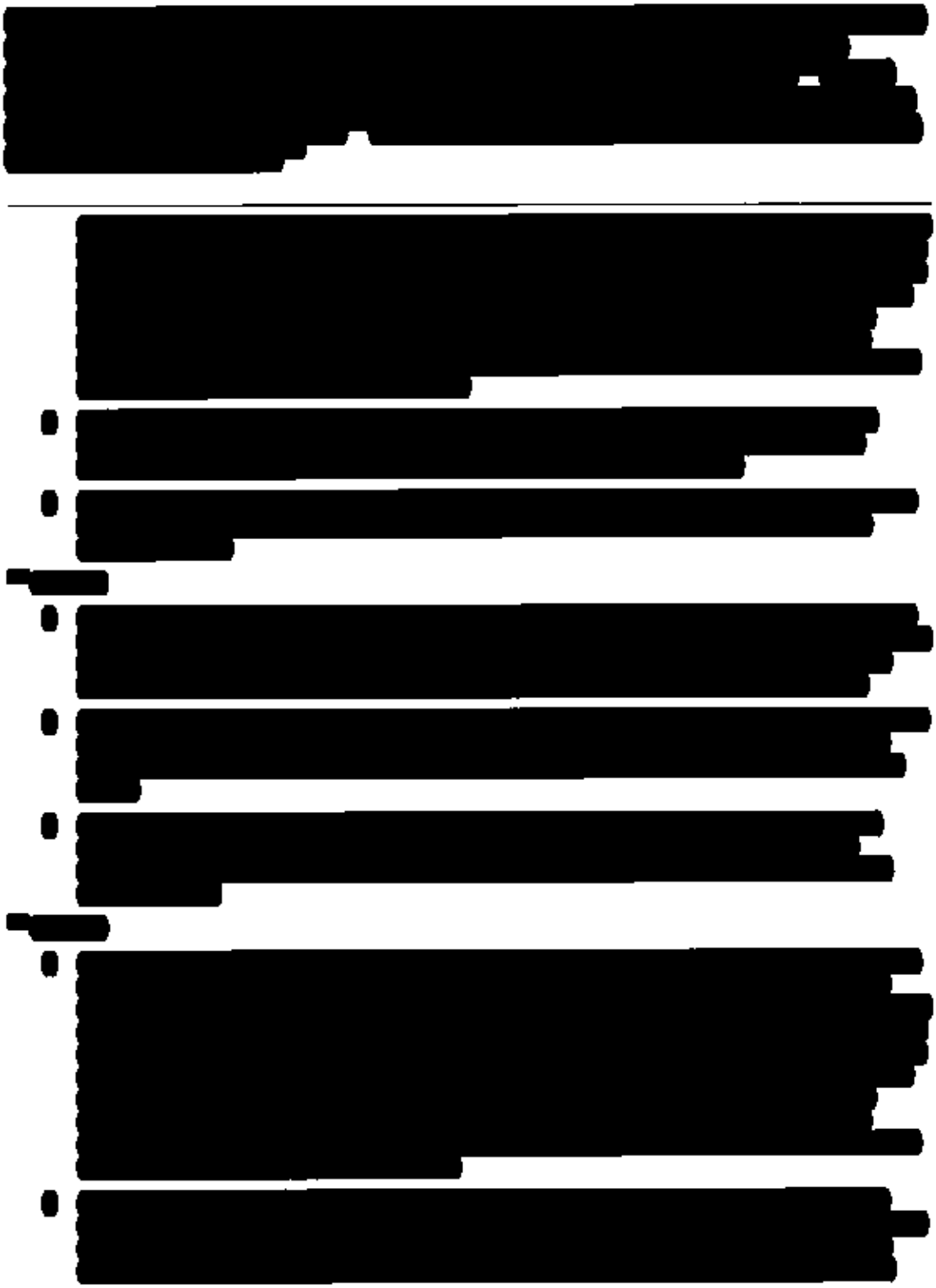
[151] Carlton, Dennis W., and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Pearson Addison Wesley, pp. 139, 141-144.

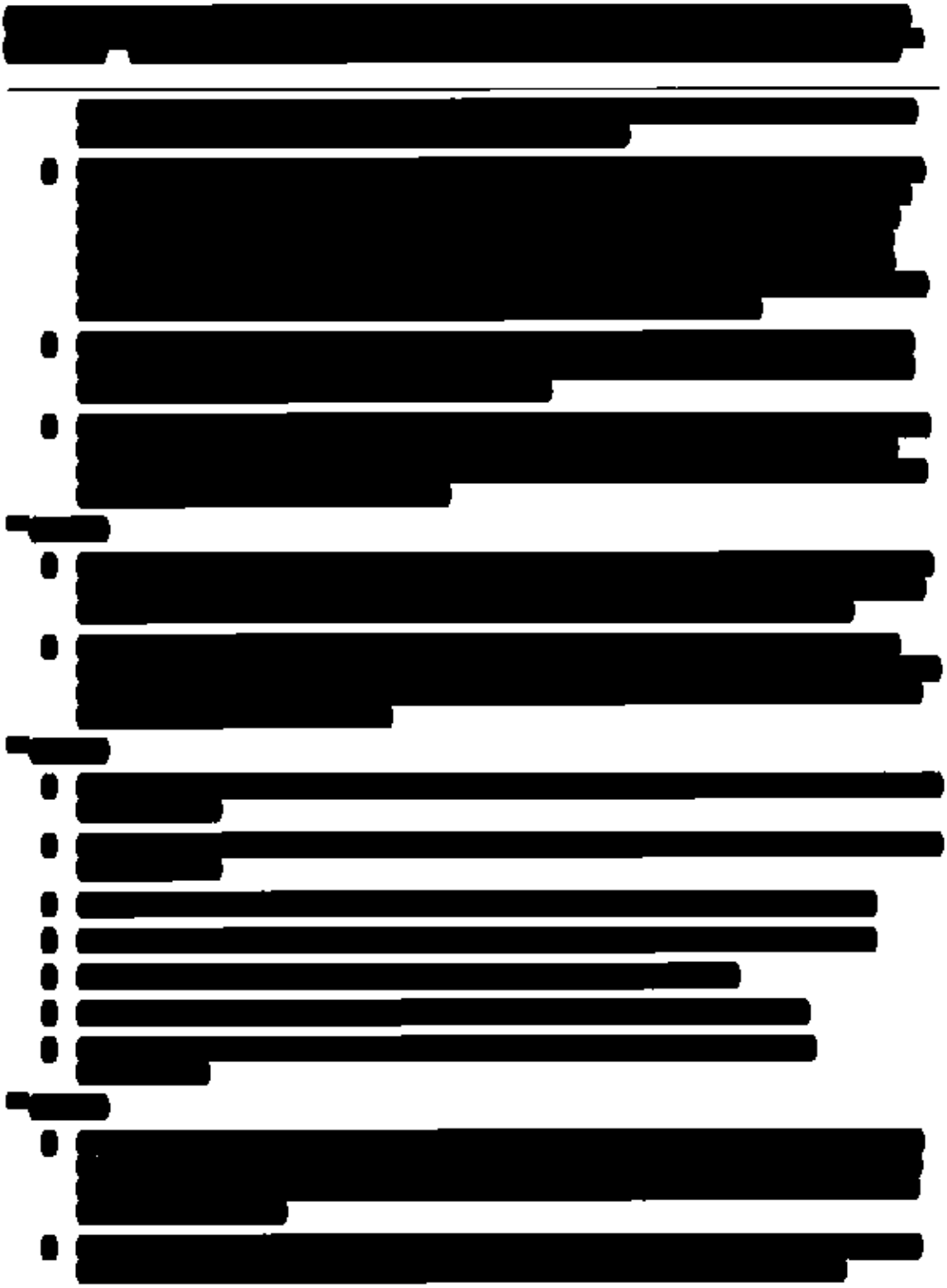
[152] Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44., pp. 43-44, 67.

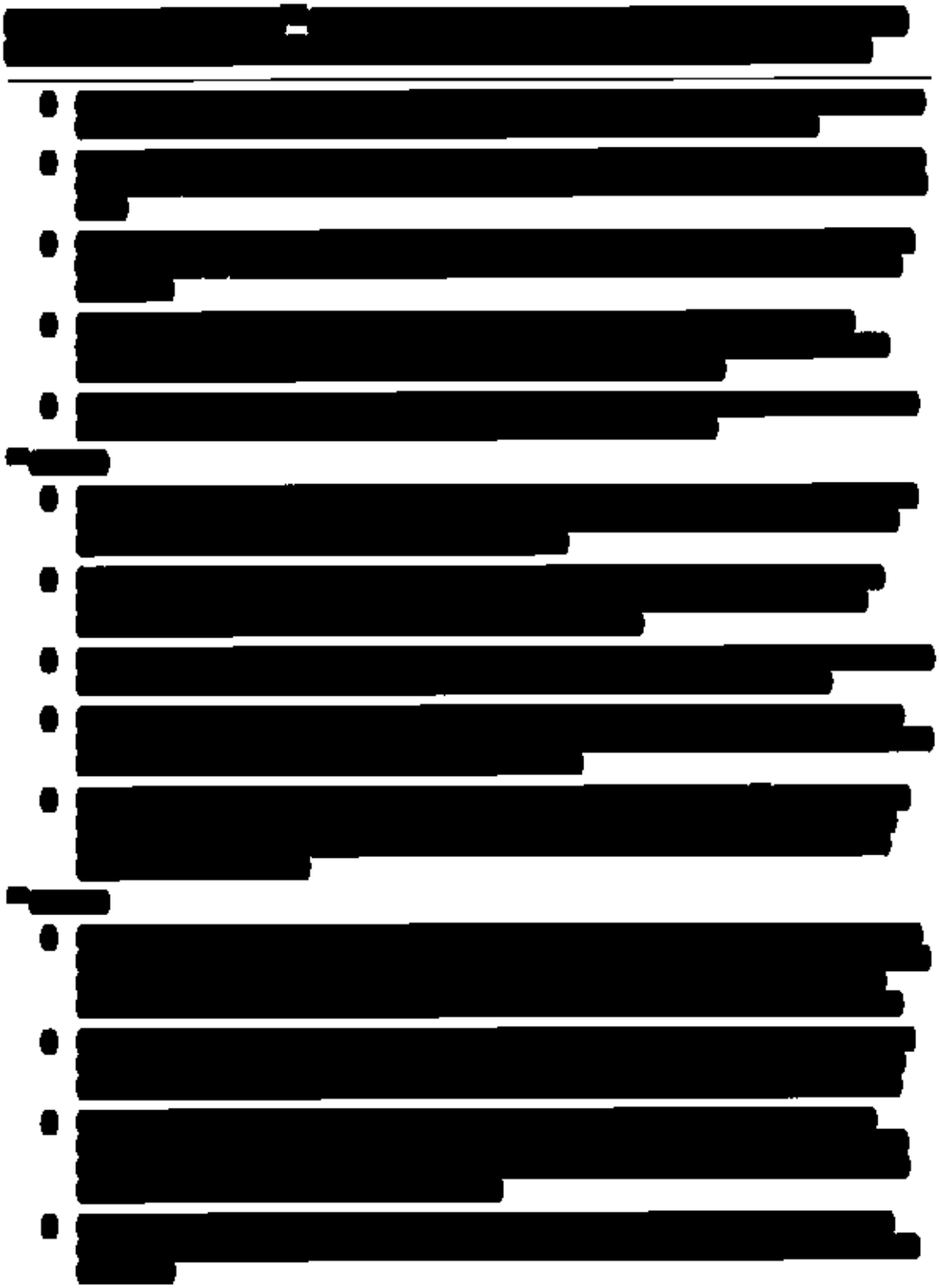
[redacted]











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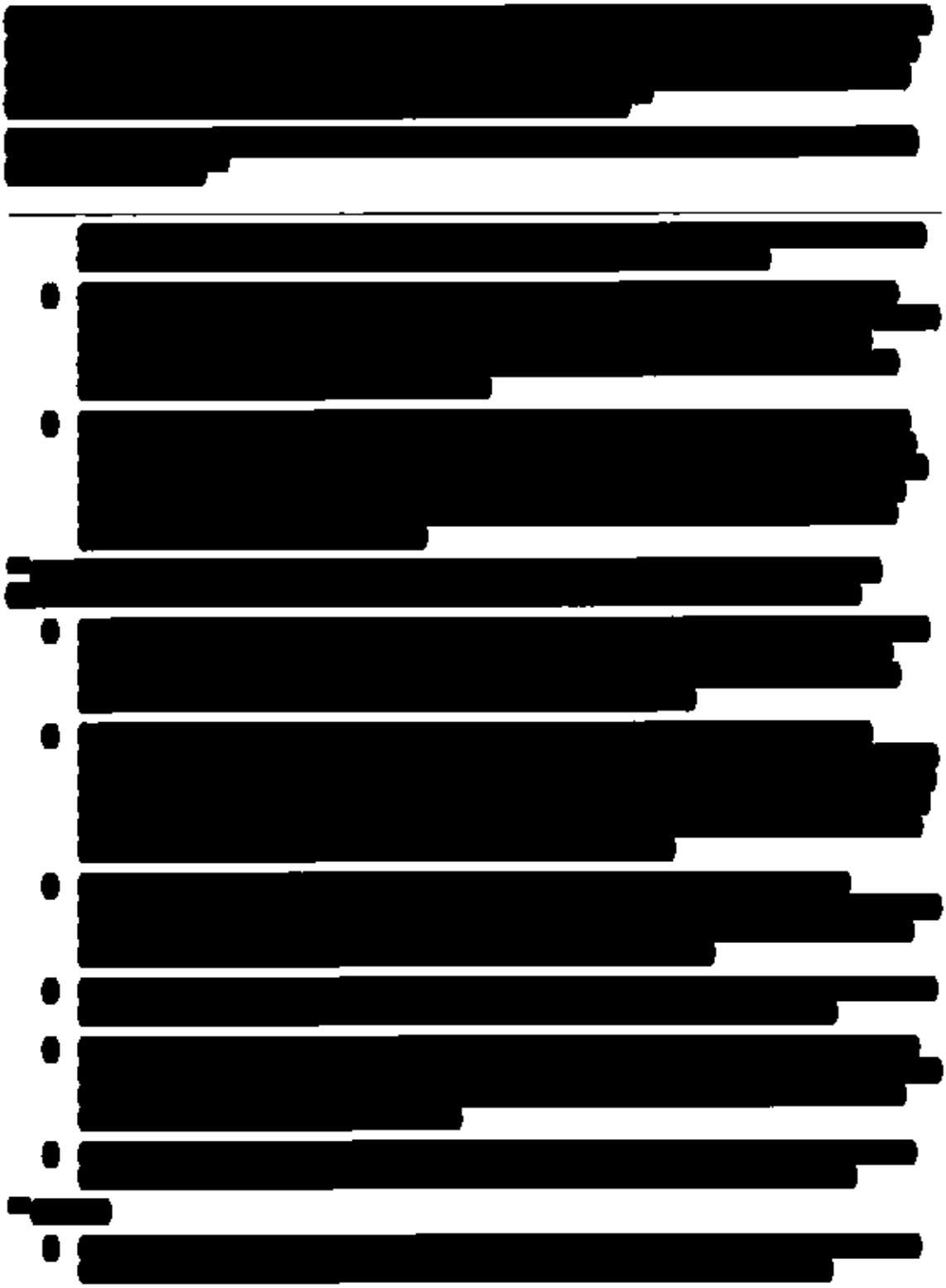
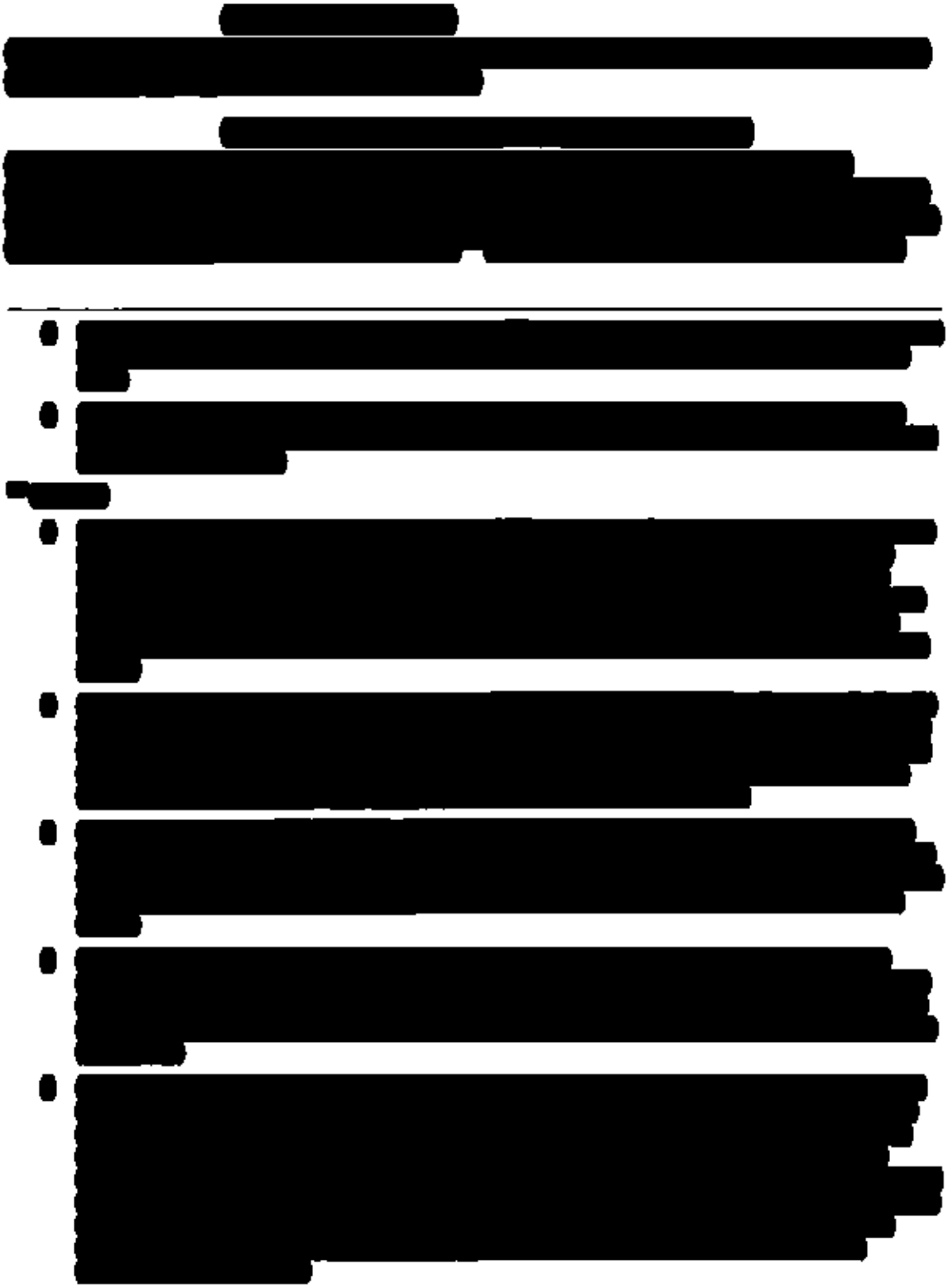
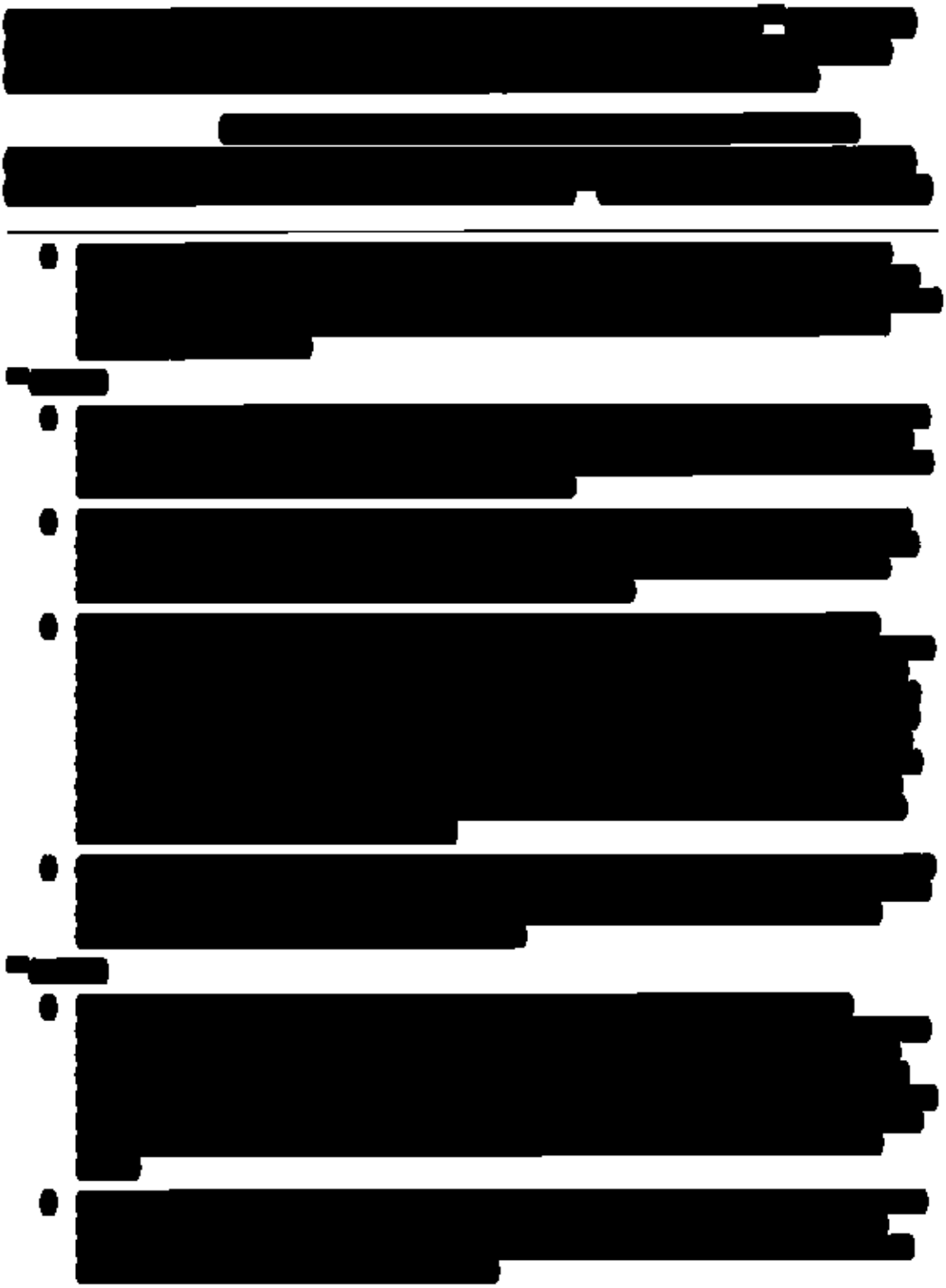
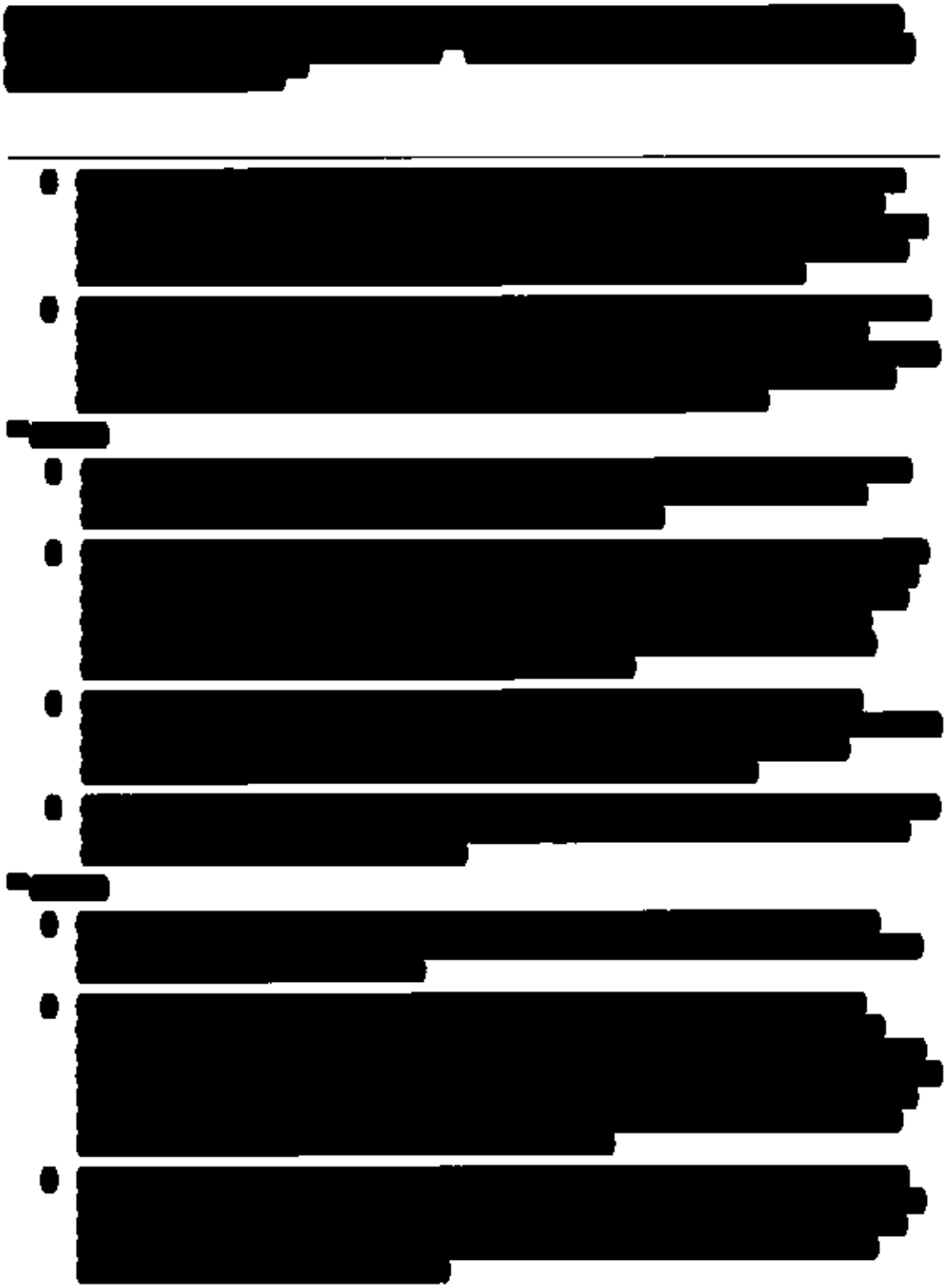
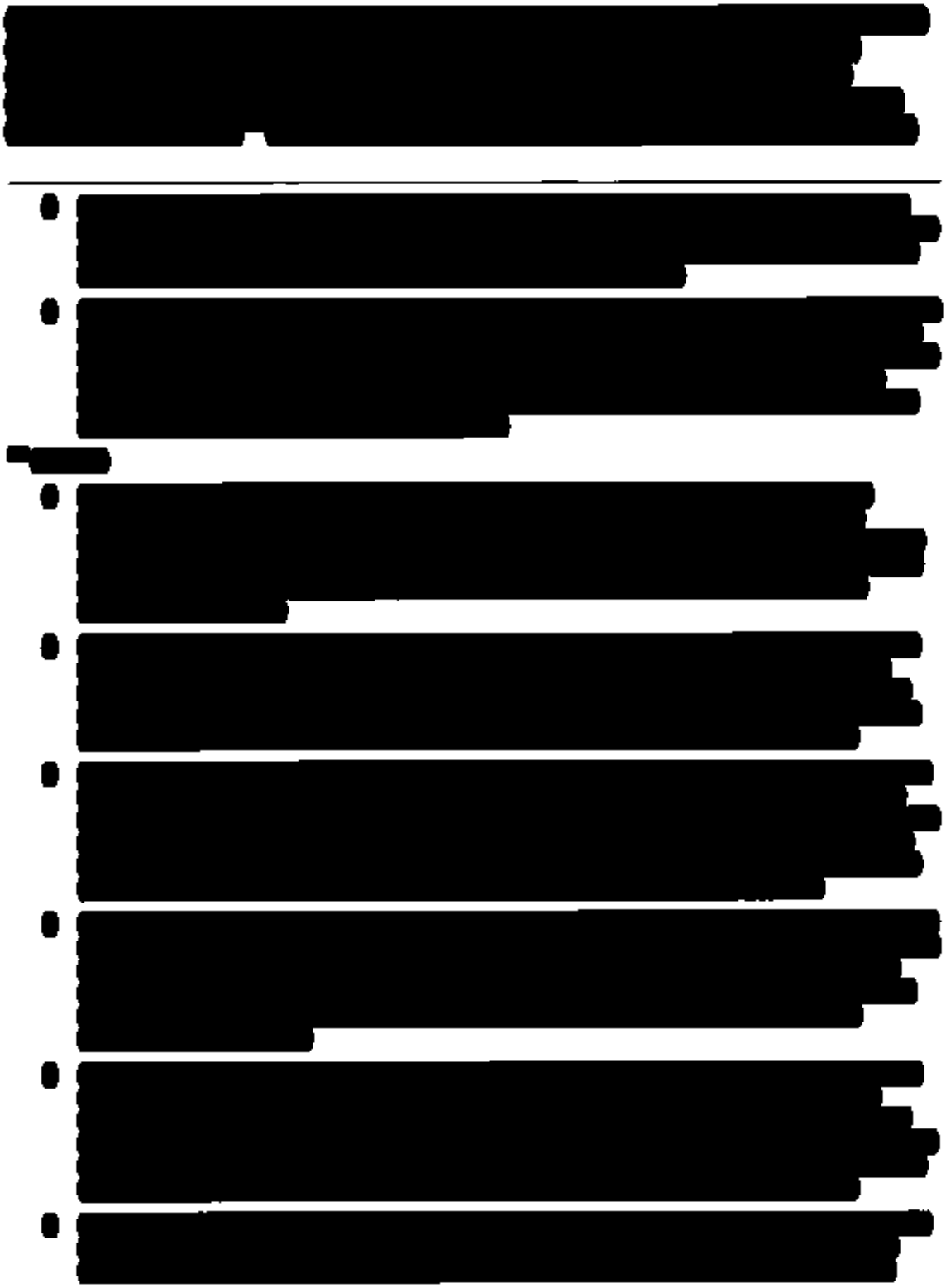
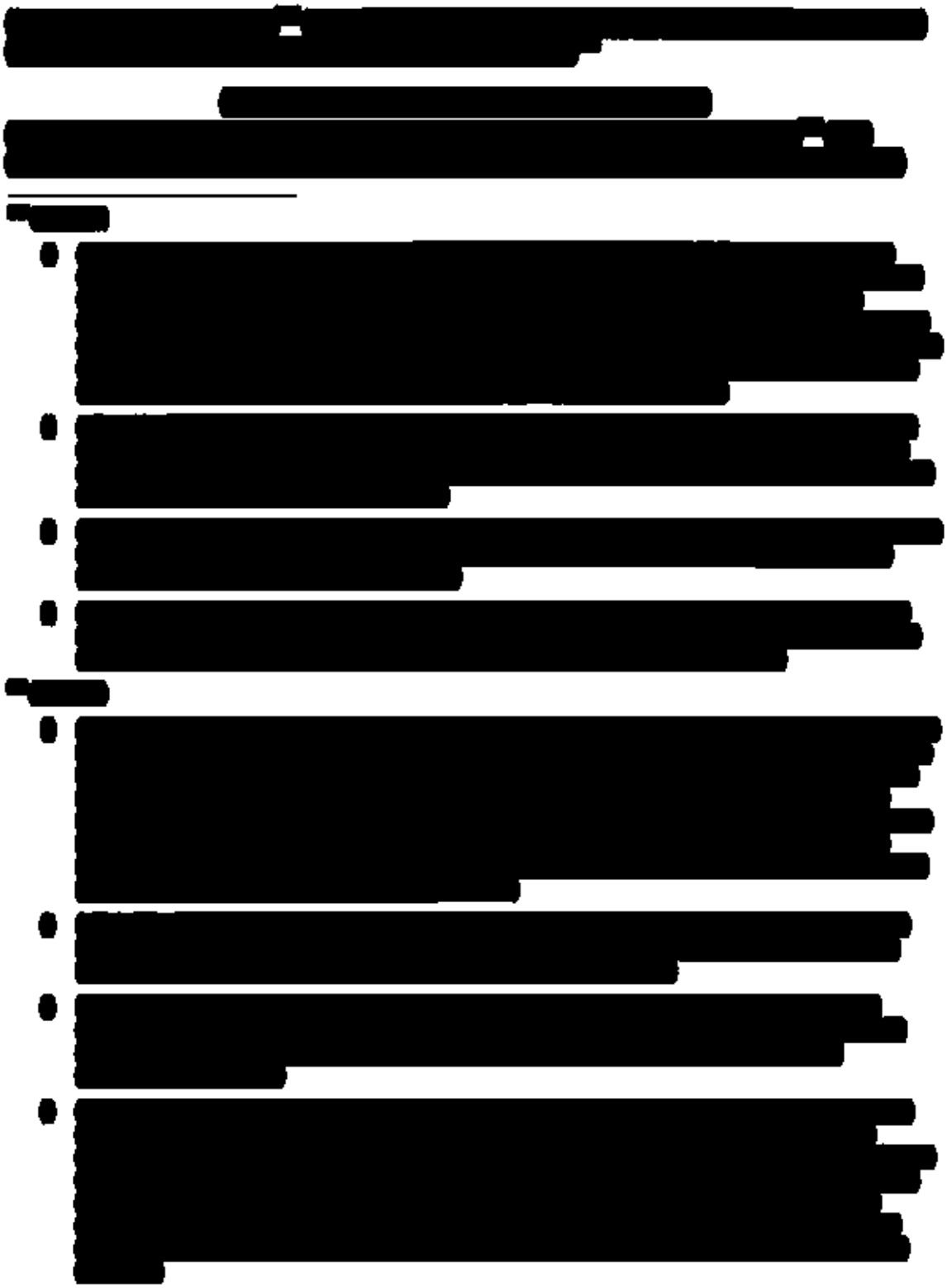












[redacted]

[redacted]

(1) Firms will not participate in a cartel if they don't expect it to succeed

For firms to participate in a cartel, members of the cartel must expect the cartel to be able to raise the price above the competitive level by an amount sufficient to compensate cartel members for the expense and risk of participating in the cartel.[185] The cost of sending executives to meetings is an example of one of the expenses of participation. For illegal cartels, the cost of participation also includes the expected cost of being caught: attorney fees, criminal fines, civil damages, and, for executives of the corporation, the costs of incarceration. It is not certain that a cartel will be caught by antitrust authorities. Therefore these costs are discounted to account for the probability of being caught and successfully prosecuted. In the event of successful prosecution, the costs are quite significant.[186]

[redacted]

[185] See, e.g.,

- "Three major factors are necessary to establish a cartel. First, a cartel must be able to raise price above the noncartel level without inducing substantial increased competition from nonmember firms... Only if a cartel is expected to raise the price above the noncartel price and keep it high do firms join. [footnote:] If the noncartel price is close to the cartel price, then firms may not believe that joining the cartel is profitable given the legal liability they potentially face from belonging to a cartel." Carlton, Dennis and Jeffery M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Addison-Wesley Longman, Inc., p. 131.
- "[F]irms will make the attempt only if the cartel is expected to be sufficiently profitable." Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, p. 48.
- "Firms may collude if the incremental payoff generated by the overcharge is more than sufficient to cover the cartel costs." Boyer, Marcel, and Rachidi Kotchoni, March 2011, The Econometrics of Cartel Overcharges, Scientific Series.

[186] See footnotes 38 and 39.

[redacted]

[redacted]The activities of the cartel were not only a violation of U.S. law, they violated the law in Japan, too.[189] Cartel members therefore knew that by participating in the cartel, they were risking significant costs.

Because participation in the cartel required members to incur significant costs, they must have expected to realize significant increases in price, since firms will not participate unless they expect the cartel to be able to raise the price above the competitive level by an amount sufficient to compensate cartel members for the expense and risk of participation.

(2) Participating in an illegal cartel for over twelve years makes no sense unless expectations of success were realized

The CRT cartel lasted longer than 90% of cartels whose duration was analyzed in a recent meta-study of cartel studies.[190] Because the expectation of success is a necessary condition for firms to participate in a cartel, we may safely conclude that throughout the class period, cartel members

[redacted]

[189] McKenzie, Liz, 07 October 2009, JFTC Slams Samsung, MT Picture in CRT Cartel Probe, Law360, http://competition.law360.com/print_article/126904, accessed 08 October 2009.

[190] The CRT cartel operated during the class period, nearly thirteen years. Levenstein and Suslow studied the longevity of 50 cartels; 45 (90%) of them lived eleven years or less. Levenstein, Margaret, and Valerie Suslow, March 2006, What Determines Cartel Success?, Journal of Economic Literature, Vol. 44, 43-95, p. 52.

expected the cartel to raise price above the competitive level. To demonstrate cartel success, then, all that remains to be shown is that cartel members' expectations were realized. This follows from the fact that cartel members had, by the end of the class period, over twelve years of experience operating the cartel, had the opportunity to withdraw from the cartel at any time, yet year after year they continued to participate. Whether to participate in a cartel is a significant business decision, and should be presumed to have been made rationally, taking proper account of the relevant costs and benefits, using the best information available. Assessing the success of the cartel at raising prices would have been central to evaluating the decision to continue to participate in the cartel. Cartel members were well placed to know whether the cartel was succeeding. They demonstrated their belief that the CRT cartel succeeded in raising prices above the competitive level by continuing to bear the expense and risk of participation in the cartel year after year. The judgment of industry leaders, made in the ordinary course of business, is powerful evidence, and this evidence demonstrates that the cartel successfully raised prices above the competitive level.

b) The cartel set target prices above the competitive level

Because cartel members must be compensated for the expense and risk they incur by participation in a cartel, a cartel will set target prices above the competitive level. To do otherwise would be to establish failure of the cartel as a goal, and to ensure that the costs of participation would not be recompensed. Prices at or below the competitive level can be achieved without incurring the expense and risk of participation in a cartel. Therefore, I conclude that the target prices set by the cartel were above the competitive level.

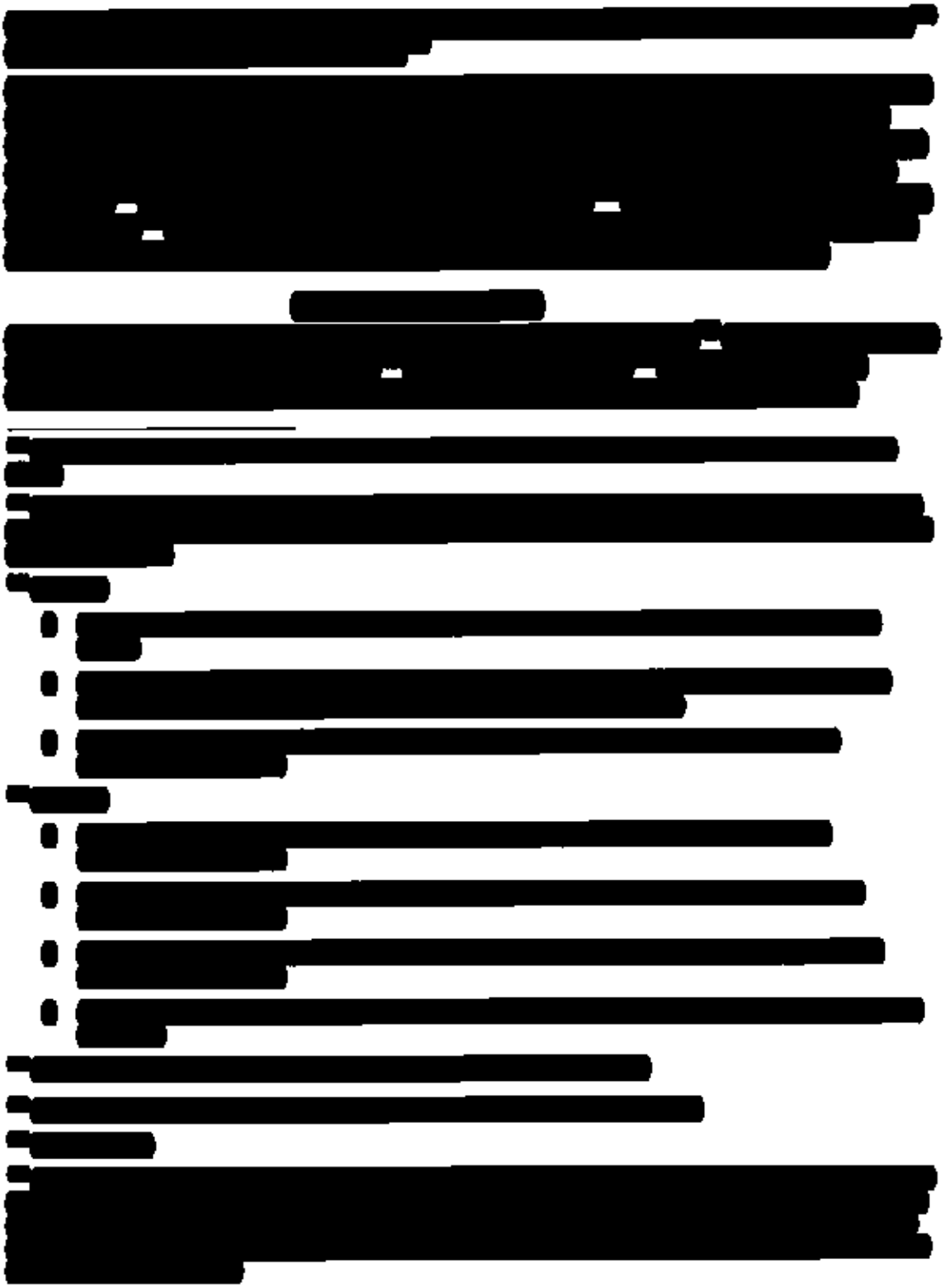
c) Cartel members' prices were near cartel target price levels

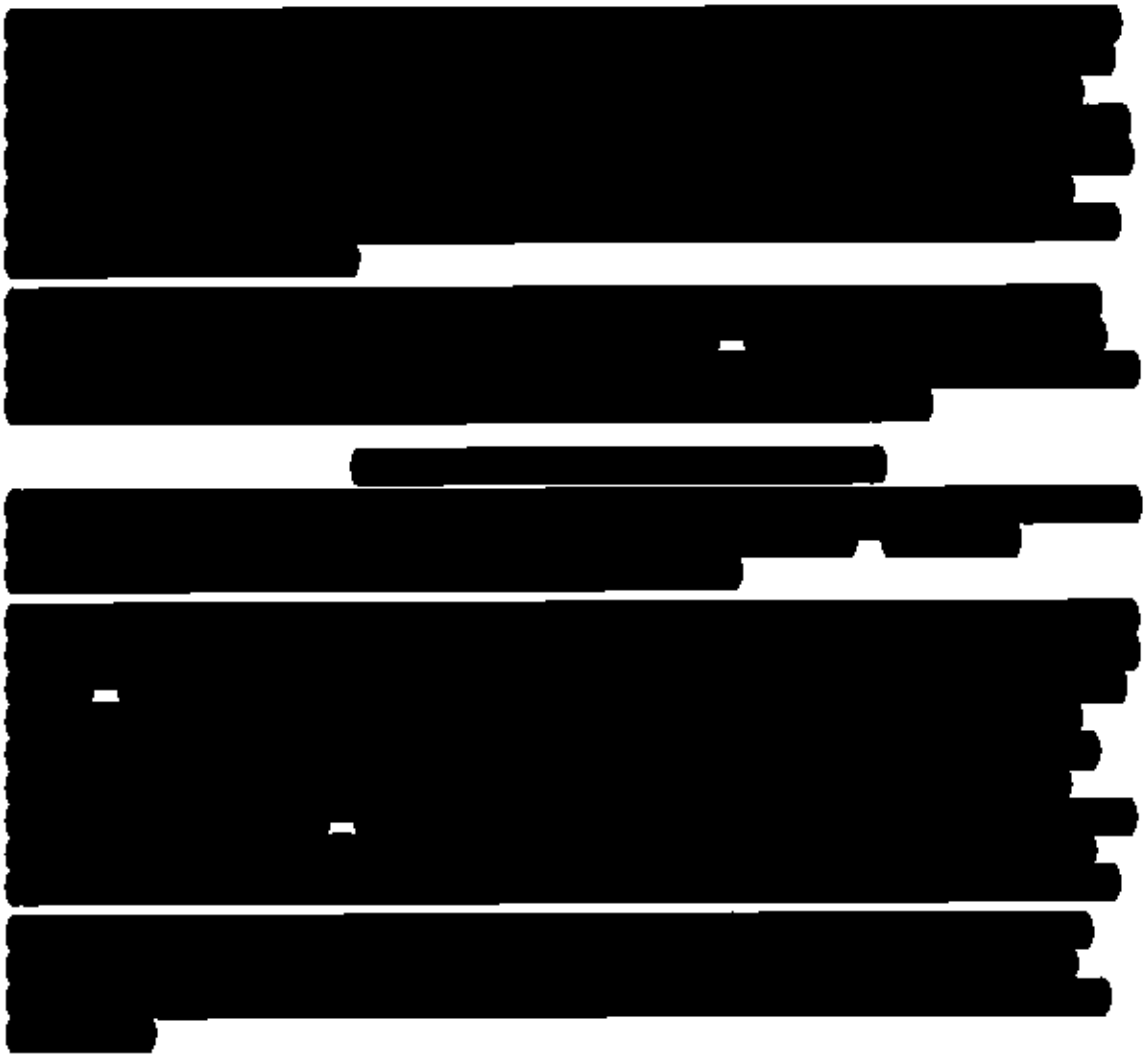
Next, I examine prices actually charged by the Defendants to test whether they were close to the cartel target prices. Note that because target prices are above the competitive level, actual prices close to the cartel target price are proof that actual prices were above the competitive level. The converse is not true, however: if actual prices are below the target prices, I cannot conclude that the cartel did not raise price. The existence of some cheating is not dispositive that the cartel was unsuccessful.[191]

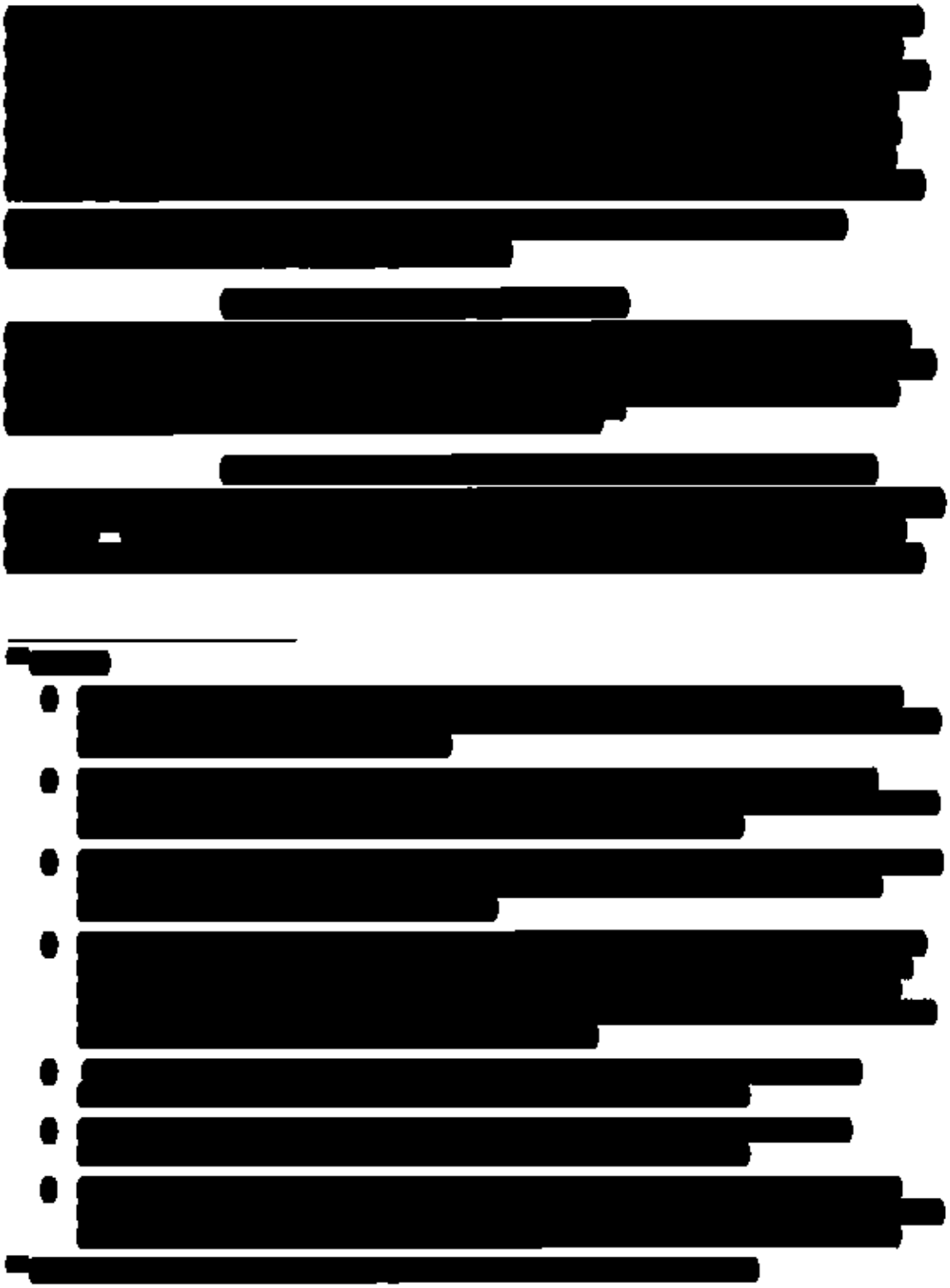
[redacted]

[191] See Section V.B.2.b).

[192] I used the following criteria to establish the target price each month for a particular type of CRT sold by a particular defendant: (*i*) I assume that target prices are only effective for any month that began within sixty days of when the price was set; (*ii*) the target price each month is the most recently fixed price prior to the first of the month, if such exists; (*iii*) otherwise, the target price is the earliest price set by the cartel, unless it was fixed after the tenth of the month, in which case I assume there was no target price for that type of CRT that month.







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The competitive level of capacity is, for each firm, the capacity that the firm would have chosen absent the cartel. Absent the cartel, each firm would have chosen capacity to maximize its own profit. Self-interest ensures that firms will make profit-maximizing choices without being monitored. If the cartel had set capacity levels at the competitive level, monitoring would not have been necessary. [redacted]

B. The cartel's impact on direct purchasers was common

In this section, I show that the cartel impacted all direct purchasers, and that proof of harm to direct purchasers is common to all members of the class. Later, at Section VIII.C and IX, I demonstrate that the impact was passed through to all indirect purchasers, and that the overcharge to direct purchasers and passed through to class members can be calculated by a formula common to class members.

1. The cartel raised the entire price structure

[redacted]

a) Rational cartelization requires that the entire price structure be raised

Substitution between differentiated products is governed by the products' relative prices. For example, if the price of a flat CDT relative to the price of a (otherwise identical) round CDT increases, other things equal, consumers will substitute away from (purchase fewer of) the flat CDTs to (purchase more of) the round CDT. A price structure describes relative prices, and therefore determines substitution between differentiated CRTs.

To operate the cartel rationally requires that the cartel raise the entire price structure, holding relative prices close to the relative prices in a competitive market. To see why this is so, consider the alternative: if the cartel raised the price of 14" CDTs above the competitive level and did not raise the price of the 15" CDTs, the price of 14" CDTs relative to 15" CDTs would rise, causing substitution away from the 14" and to the 15" CDT. If the 15" CDT were not priced supra-

[redacted]

substitution away from the 14" and to the 15" CDT. If the 15" CDT were not priced supra-competitively, this substitution would partially defeat the purpose of raising the price of the 14" models. The cartel can avoid such unprofitable substitution by raising the entire price structure, leaving relative prices substantially the same in the actual world as in the but-for world.

b) Raising one price causes neighboring prices without targets to rise

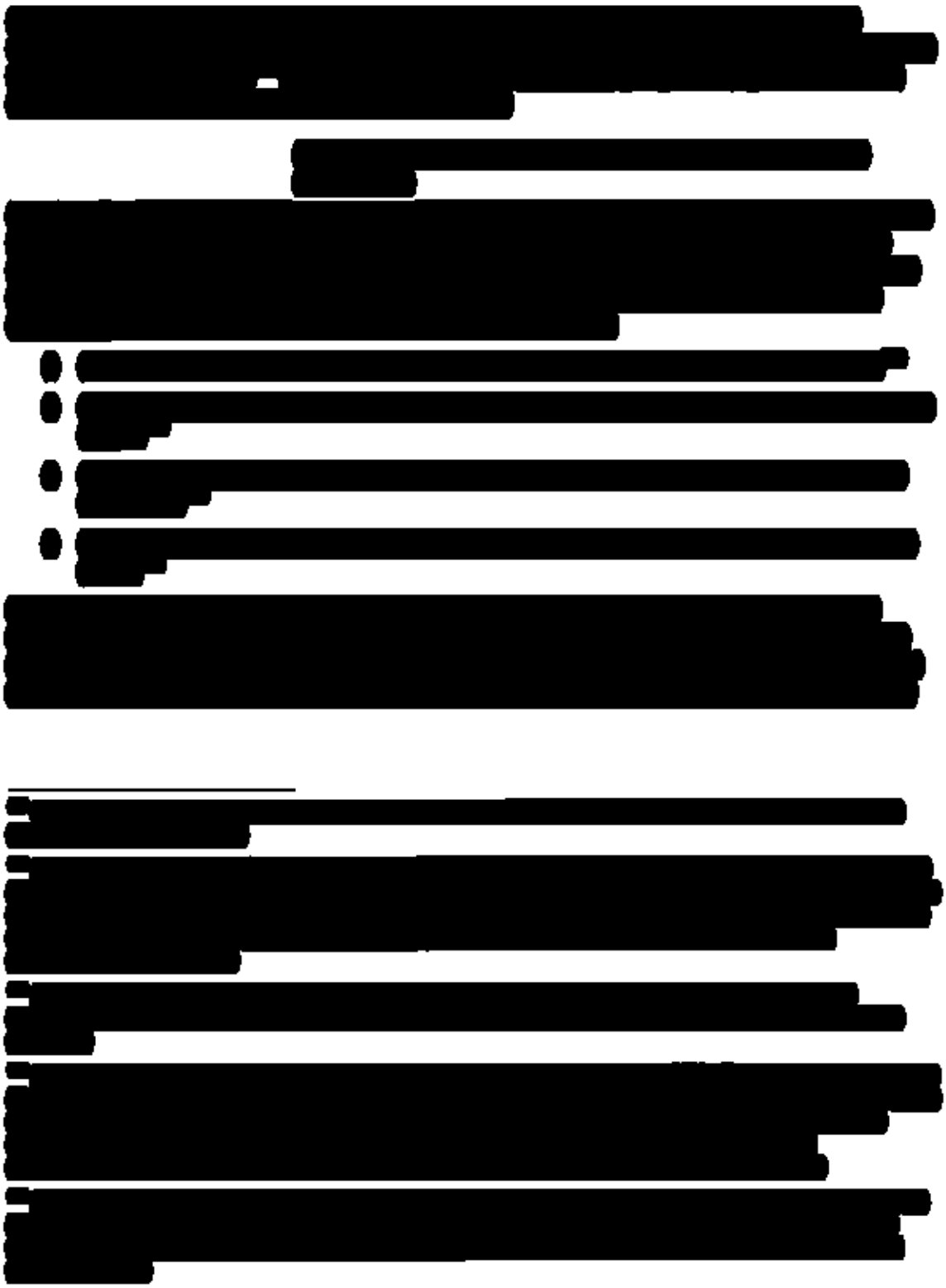
Fixing the price of one CRT can cause the prices of "neighboring models" of CRTs to rise, even without explicitly fixing the price of the neighbors, solely through the effect of market forces. Suppose, for example, that the cartel raised the price of price of round 17" CDTs but did not set a target price for flat 17" CDTs. The price of flat 17" CDTs would fall relative to the price of round 17" CDTs, causing consumers to substitute away from round to flat CDTs, causing the demand curve for flat CDTs to increase, which would cause the market equilibrium price of flat CDTs to rise because the cartel raised the price of the neighboring round 17" CDTs.[209] The exercise of market power on one model can therefore be transmitted to the nearest neighbors of that model, and the neighboring models can transmit market power further to their neighbors (19" flat CDTs, for example), causing the prices of those products to rise. Therefore, by establishing a price structure for a subset of CRTs, the cartel can cause the prices of all CRTs to rise, even those for which the cartel did not explicitly set a target price.[210] In practical terms, the magnitude of the effect is likely to be small on models far removed in product space from the single model whose price was changed (e.g., if the price on 14" CDTs increased by $5, the impact on the price of 21" CDTs would be smaller). However, by setting a subset of all prices, distributed throughout the product space, the cartel can raise the entire structure.

[redacted]

[209] The price of flat 17" CDTs would not increase when demand for the product increased only in the improbable case that sellers would sell up to an infinite amount of flat 17" CDTs regardless of the level of demand.

[210] The USITC found a similar effect in televisions. The differentiator the Commission was interested in was quality; it found that "there is some degree of brand and perceived quality differentiation in the CTV [CRT TV] market. We do not, however, find that the market is characterized by discrete, rigidly-defined quality tiers. Instead, prices at the low end of the market can affect prices in other portions of the market." United States International Trade Commission, May 2004, Certain Color Television Receivers from China, USITC Publication 3695, http://www.usitc.gov/publications/701_731/pub3695.pdf, accessed 17 May 2012 at 11, emphasis supplied.

[redacted]



[redacted]

d) Cartel target prices exhibit a structure

In this section, I analyze the cartel's target prices, and present empirical evidence that the target prices set by the cartel can be closely approximated by a function of product characteristics. Models of price as a function of product characteristics are called "hedonic".[219] [redacted]

I test for the presence of a structure in cartel target prices by evaluating how well cartel target prices can be approximated by a function of CRT characteristics. I estimate the hedonic equation using linear regression. If cartel target prices fit the model well, the hedonic regression will show that a price structure exists. A measure of the goodness of fit of the regression is the R-squared, denoted R^2: if the R^2 is close to 1, then product prices are largely determined by product characteristics in a formulaic way. The R^2 gives the percentage of the variation in the dependent variable that is explained by the regression.[220] In that case, there is a price structure and, at any given time, cartel target prices are determined largely by product characteristics, and whether the buyer was a major customer.[221]

I estimated two hedonic regressions, one for CPTs and one for CDTs. The regression I estimated for CPTs is

$$\log(Price_t) = \beta_0 + \beta_1 ITC_t + \beta_2 Flat_t + \lambda Size_t + \beta 3 \quad Major_t + \gamma_1 Time_t + \gamma_2 Time_t^2 + \varepsilon_t,$$

where ITC_t is an indicator variable equal to one if target price t is for a CPT sold "ITC" rather than "bare"; $Flat_t$ is an indicator variable equal to one if target price t is for a flat-screen CPT; $Size_t$ is a vector of indicator variables for different screen sizes; $Major_t$ is an indicator variable equal to one if target price t is for a major customer and equal to zero otherwise; and $Time$ is

[redacted]

[218] For example, if a standard 19" CDT is priced at $160, the differentials specified above create prices for the following seven products: 19" CDT with premium coating; 19" CDT with premium frequency; 19" CDT with premium dot pitch; 19" CDT with premium coating and frequency; 19" CDT with premium coating and dot pitch; 19" CDT with premium frequency and dot pitch; and 19" CDT with premium coating, frequency and dot pitch. Among these eight products (the standard version and seven differentiated products) there are 28 pairs of prices, with a relative price associated with each pair.

[219] Hedonic models are widely used by economists interested in the correlation between the price of goods and the features or qualities they possess. For a survey of the recent literature on hedonic price models and an application to PDAs, see Chwelos, Paul D., Ernst R. Berndt, and Iain M. Cockburn, November 2008, Faster, Smaller, Cheaper: An Hedonic Price Analysis of PDAs, Applied Economics, Vol. 40(2), 2839-2856.

[220] Wooldridge, Jeffrey M., 2000, Introductory Econometrics: A Modern Approach, South-Western College Publishing; Mason at 40.

[221] Major customers are Aiwa, Funai, Orion, SREC, TCE, Samtel, Ekranas, Philips, Toshiba, IRICO, and BMCC. These are large customers for whom the cartel frequently established individualized prices.

time.[222] In the equation above, at any given time, prices charged to major customers are determined entirely by a product characteristics: size, shape, and whether a CPT is sold ITC; prices charged non-major customers are determined the same way, but can differ from prices charged major customers by some percentage common to all CPTs.

The results of the hedonic regression for CPTs are in Exhibit 19. To illustrate how to read the results of the regression, the estimated target price premium for CPTs sold ITC above the price of those sold bare is about 11%, and the target price premium for flat CPTs above round CPTs is about 20%.

The regression as a whole is highly statistically significant, and the R^2 for this regression is .98. In other words, the product characteristics, time trends, and whether the direct purchaser was considered a major customer by the cartel explain 98% of the variance of the log of CRT price. By adjusting the R^2, I find that the product characteristics, time trends, and whether the direct purchaser was considered a major customer by the cartel explain 98% of the variance of the CRT price itself, rather than its logarithm.[223,224]

The regression I estimated for CDT target prices is

$$\log(Price_i) = \beta_0 + \beta_1 Flat_i + \lambda Size_i + \beta_2 Major_i + \gamma_1 Time_i + \gamma_2 Time_i^2 + \varepsilon_i$$

The variables are defined as above.[225]

The results of the hedonic regression for CDTs are in Exhibit 20. This regression, like the CPT target price regression, is highly significant, with an R^2 of 91%. Adjusting the R^2, I find that 91% of the variation in cartel target prices is explained by product characteristics, time trends, and whether the direct purchasers is considered a major customer by the cartel.[226]

I concluded in the previous section that when the cartel fixed prices by setting differentials, it established a structure in its target prices. In the hedonic regressions, I analyze all of the cartel target prices I have found to date, those created by setting price levels as well as those created by setting price differentials, and conclude that a price structure exists in the cartel's target prices.

e) Defendants' sale prices exhibit a price structure

In this section, I analyze the prices Defendants charged their customers using hedonic regression to determine the extent to which the prices Defendants charged to direct purchasers can be closely approximated by a formula common to all direct purchasers. I also decompose the

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[222] I include a time trend in the hedonic regression in order to estimate the effect of the other variables (such as size and shape) while controlling for the effect of regular changes over time.

[223] I calculate the percentage of variation in price using the Duan smearing estimator. For a description of the Duan Smearing estimator, see Duan, Naihua, September 1983, Smearing Estimate: A Nonparametric Retransformation Method, Journal of the American Statistical Association, Vol. 78, No. 383, 605-610.

[224] These results show that measuring the proportion of the variation of price and the logarithm in price give very similar results.

[225] I do not include a variable indicating the finish (ITC or bare) because the target prices for CDTs generally does not include that information.

[226] I calculate the percentage of variation in price using the Duan smearing estimator. For a description of the Duan Smearing estimator, see Duan, Naihua, September 1983, Smearing Estimate: A Nonparametric Retransformation Method, Journal of the American Statistical Association, Vol. 78, No. 383, 605-610.

variance in sales prices explained by three categories of variables: the variance attributable to product characteristics and time, the variance attributable to buyer-seller pairs, and the variance left unexplained. Based on the results, I conclude that the majority of the variance in prices paid by direct purchasers is attributable to the common factors of product characteristics and a time trend.

The Defendant sales data I used for this analysis are described in Section VIII.A.3.c)(2). Briefly, the Defendant sales data identify the seller, the buyer, sales revenue, and quantity sold, by a large number of CRT models. Four Defendants produced transaction-level data and two Defendants produced monthly data, with no transaction-level detail. I cleaned the data as described in footnote 200. I aggregated the transaction-level data across transactions within a month to reduce the noise due to returns and credits, as explained in footnote 201. For the analysis described here, I did not aggregate sales data across "groups" of models, as I did when I compared sale prices to cartel target prices in Section VIII.A.3.c).

I estimated a hedonic regression of price as a function of product characteristics, a time trend, and indicator variables for buyer-seller pairs using linear regression. Mathematically, the regression I estimated is

$$\log(Price_{ijt}) = \beta_0 + \beta_1 Char_i + \beta_2 SB_j + \gamma_1 Time_t + \gamma_2 Time_t^2 + \varepsilon_{ijt},$$

where $Price_{ijt}$ is the price charged for CRT model i between seller-buyer pair j at time t; $Char_i$ is a vector of indicator variables for product characteristics, including aspect ratio (wide or not), size, and finish (bare or ITC) of CRT model i; SB_j is an indicator variable for seller-buyer pair j;[227] and the time variables allow for a trending influence on price.[228] I fit the model separately for CDTs and CPTs. The results of the regressions are presented in Exhibits 21 and 22.

Both regressions are highly significant. The R^2 of the CDT regression is 0.92, which means that92% of the variation in the logarithm of price for CDTs can be explained by product characteristics, buyer-seller pairs, and a time trend. The R^2 of the CPT regression is 0.96, which means that 96 of the variation in the logarithm of price for CPTs can be explained by product characteristics, buyer-seller pairs, and a time trend.[229]

The proportion of variation in the logarithm of price that is explained by the hedonic model, R^2, can be decomposed into the proportion of variation explained by each individual independent (right-hand side) variable or a subset of the independent variables.[230] I decompose the explained variation into the proportion explained by the product characteristics and time trend, R^2_{CT}, and the

[227] Seller-buyer pairs are identified by customer names in each defendant dataset. Alternate spellings of a single customer name within a given defendant dataset results in separate seller-buyer pairs for each spelling variation.

[228] For notational ease, in this representation β_1 and β_2 represent sets of coefficients. The set of β_1 coefficients includes coefficients for each level of product characteristic observed in the data. For example, there is a coefficient for each size of CRT. Similarly, the set of β_2 coefficients includes a coefficient for each seller-buyer pair.

[229] To allow for the measurement of the explanatory power of variables groups (described in the following paragraph), I examine the variance in the logarithm of price. The variation in price and the logarithm of price are very close; see footnote224.

[230] Fields, Gary S., March 2004, Regression-Based Decompositions: A New Tool for Managerial Decision-Making, Cornell University, Department of Labor Economics, http://www.ilr.cornell.edu/directory/downloads/fields/Author_decomposingRegressions_mar04.pdf, accessed 21 September 2012.

proportion explained by the buyer-seller pairs, R^2_{SB}. That is, the proportion of the total variation in the logarithm of price that is explained by the regression is $R^2 = R^2_{CT} + R^2_{SB}$, and the proportion of unexplained variation is simply $1 - R^2$.

These results demonstrate that over 71% and slightly less than 89% of the variation in the logarithm of CDT and CPT tubes, respectively, is explained by product characteristics and time. The proportion explained by buyer-seller pairs is 21% and 8 % of CDTs and CPTs, respectively. Only 8% and 4% of the variance in the logarithm of price is not explained by the hedonic regression.

Only two of the six sets of sales data produced by Defendants contain information about CRTs' shape, which is a characteristic relevant to pricing. To gauge the effect shape would have on the decomposition of variance described above, I re-estimated the hedonic regression of sales prices using the sales data from Panasonic and Samsung, which include information about shape, including and excluding shape. I perform the decomposition of variance described above in the regression with and without shape included as regressors. By estimating two regressions that use the same data and are the same except for the inclusion of shape as a regressor, I am able to assess the effect of shape on the decomposition of variance. The regression results are in Exhibits 23 and 24.

I find that the regressions that include shape as a regressor explain a negligibly higher proportion of the variance of the logarithm of price; the R^2 increases from 0.9435 to 0.9436 for CDTs and from 0.9637 to 0.9708 for CPTs. The decomposition of variation explained by product characteristics and time trends is nearly the same for CDTs. For CPTs, including the shape variable slightly increases the proportion of the variance in the logarithm of price that is explained by product characteristics and time trends (from 0.90 to 0.93) and slightly decreases the proportion explained by buyer-seller pairs (from 0.07 to 0.04).

The conclusion is clear. If transaction prices were driven primarily by individual factors such as the nature of the class member or the outcome of a specific negotiating procedure between each Defendant and each direct purchaser, then I would not find a common pricing structure determined by common CRT characteristics that would explain a majority of the variation in prices. The hedonic regressions on sales prices show that there is a common pricing structure; CRT prices are largely determined by a formula based on the characteristics of the product and the period in which the transaction took place. The results of the hedonic analysis clearly indicate that common factors overwhelm the individual factors in determining CRT prices. The implication is that prices respond similarly to common market forces and therefore the target price structure the cartel put in place had the effect of causing the prices of all CRTs to be above the competitive level, not merely the CRTs whose prices were fixed by the cartel. I conclude that proof of harm does not require individualized inquiry into the effect of the cartel's conduct on any particular product or buyer; it is common to all class members.

2. Even cheaters' prices are above competitive prices

Cartel cheaters, by definition, charge prices below the cartel target price; this is a form of price competition. But, if cheating is not ubiquitous, cheating is a limited form of competition that yields supra-competitive prices. This is because the cartel members that cooperate with cartel policy provide a price umbrella: buyers must pay the supra-competitive cartel target price if they do not buy from cheaters, so cheaters can sell at prices below the cartel target price but still above the competitive level. More formally, the proof by which I showed that exercise of market

power is transmitted throughout the price structure[231] can be adapted to apply here. Products offered by cheaters are substitutes for products offered by non-cheating cartel members. When non-cheating cartel members set prices above the competitive level, the cartel causes demand for substitute CRTs offered by cheaters to shift out, raising buyers' willingness to pay for cheaters' CRTs. Cheaters can therefore charge supra-competitive prices for CRTs that are substitutes for CRTs priced at cartel target levels.

3. Cartelizing conduct impacts the entire industry

[redacted]

1. Economic theory shows that pass-through of overcharges is positive

Economists routinely study the impact of changes in costs (in this case, a change in the cost of a CRT) on prices (in this case, the price of a product containing a CRT). Economists refer to the

[231] See Section VIII.B.1.c).

concept of upstream costs leading to changes in downstream prices as "pass-through" (also sometimes called "pass-on"). The pass-through rate quantifies the degree to which output prices change when costs change.[232,233] For example, a pass-through rate of 110% means that when costs increase by $1, prices increase by $1.10.

Pass-through can occur at each stage of the manufacturing and distribution process. For example, consider the market for gasoline. An increase in the price of crude oil can cause an increase in the price of wholesale gasoline, which can cause an increase in the rack price of gasoline paid by gas stations, which, in turn, can cause an increase in the retail price of gasoline. Indeed, studies on this issue have shown that changes in the cost of crude oil (at the top of the distribution channel) are passed-through to consumers of gasoline (at the bottom of the distribution channel).[234]

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[232] E.g., if a $50 increase in costs causes prices to increase by $55, then the pass-through rate is 110% ($50 × 110% = $55). Mathematically, the pass-through rate is the partial derivative $\partial p/\partial c$, where p represents price and c represents cost.

[233] There is another relationship between cost and price that is sometimes confused with pass-through. This is a term called mark-up. The mark-up rate refers to the average relationship between cost levels and price levels. It is calculated as total price divided by total cost. While the mark-up rate is a relationship between price and cost levels, the pass-through rate refers to the relationship between cost and price changes.

[234] See, e.g.,

- Asplund, Marcus, Eriksson, Rickard, et al., 2000, Price Adjustments by a Gasoline Retail Chain, Scandinavian Journal of Economics, Vol. 102(1), pp. 101-121.
- Bachmeier, Lance J., and James M. Griffin, 2003, New Evidence on Asymmetric Gasoline Price Responses, The Review of Economics and Statistics, Vol. 85(3), pp. 772-776.
- Balke, N.S., Brown, S.P.A., and M.K. Yucel, 1998, Crude Oil and Gasoline Prices: An Asymmetric Relationship?, Federal Reserve Bank of Dallas Economic Review, pp. 2-11.
- Burdette, Michael, and John Zyren, January 2003, Gasoline Price Pass-through, Energy Information Administration, http://www.eia.doe.gov/pub/oil_gas/petroleum/feature_articles/2003/gasolinepass/gasolinepass.htm, accessed 26 July 2005.
- Duffy-Deno, K.T., 1996, Retail Price Asymmetries in Gasoline Local Markets, Energy Economics, Vol 18, pp. 81-92.
- Energy Information Administration, November 2003, 2003 California Gasoline Price Study Final Report, Department of Energy.
- Godby, R., Lintner, A.M., et al., 2000, Testing for Asymmetric Price Responses in the Canadian Gasoline Market, Energy Economic, Vol. 22, pp. 349-368.
- Kirchgassner, Gebhard, and Knut Kubler, 1992, Symmetric or Asymmetric Price Adjustments, Energy Economics, Vol. 14, pp. 171-185.
- Reilly, B., and R. Witt, 1998, Petrol Price Asymmetries Revisited, Energy Economics, Vol. 18, pp. 297-308.
- Shin, David, December 1992, Do Product Prices Respond Symmetrically to Changes in Crude Prices?, American Petroleum Institute, Research Study #068, pp. 137-157.
- Weinhagen, Jonathan, July 2003, Consumer Gasoline Prices: An Empirical Investigation, Monthly Labor Review, Vol. 126(7), pp. 3-10.

A fundamental result in economics is that firms increase price when faced with an increase in cost in most situations. The incentives to increase price in response to a cost increase are particularly strong when the following conditions are true: the cost increase affects all firms without changing their relative competitive position, and the cost increase is perceived to be non-transitory. This pass through occurs regardless of the market structure of the industry facing the cost increase; that is, economic theory shows that an industry-wide, non-transitory cost increase leads to an increase in price whether the industry is monopolistic, oligopolistic, or competitive. While the magnitude of pass-through differs depending on the market structure and the shape of demand for the product, pass-through is positive.[235] Put in the context of this case, economic theory predicts that CRT product prices (i.e., the amount class members pay) increase when CRT prices (i.e., the amount direct purchasers pay) increase.

a) Pass-through is positive in both perfectly competitive and imperfectly competitive markets

In a perfectly competitive market,[236] economic profits are zero in the long-run.[237] If economic profits were negative, firms would exit, causing prices to rise, until economic profits returned to zero; on the other hand, if economic profits were positive, firms would enter, causing prices to decline, until profits returned to zero. If a perfectly competitive firm faced a cost increase that also impacted its competitors, but did not pass through the higher input costs, the firm would earn negative economic profits and would eventually go out of business. In other words, not passing through cost increases would mean the firm would lose money on each unit sold, which is simply not a rational long-term strategy for a profit-maximizing firm.[238] Now suppose that the perfectly competitive market also displays an economic characteristic known as "constant costs", which means the market can grow to any size without driving up the costs of its inputs.[239] In this case, the long-run pass-through rate of an industry-wide cost increase is 100%, which means that if costs rise by $1, prices also rise by $1. Economic theory establishes that when an industry is

[235] Furthermore, I am aware of no empirical study that contradicts the theoretical findings. That is, I am aware of no study published in a peer-reviewed journal that has found a pass-through rate of zero.

[236] A perfectly competitive market is one in which there are many buyers and sellers, none of which can affect prices in any significant manner; there is a homogeneous good; there is perfect information; and there is free entry and exit. Agriculture markets are often considered nearly perfectly competitive. In the market for wheat, for example, there are thousands of sellers (farmers producing wheat) and thousands of buyers who produce flour and other products. In the wheat market, no individual seller or buyer can significantly affect the price of wheat. Pindyck, Robert S., and Daniel L. Rubinfeld, 2005, Microeconomics: Sixth Edition, Prentice Hall: Upper Saddle River.

[237] A firm's profitability can be measured using either accounting profit or economic profit. Accounting profit is a firm's revenues minus the total costs of producing goods or services including labor, raw materials, and interest plus depreciation expenses. Economic profit is a firm's total revenue minus the total opportunity cost of the inputs. Therefore, economic profits, unlike accounting profits, consider the return a firm would earn if its capital were used elsewhere. Pindyck, Robert S., and Daniel L. Rubinfeld, 2005, Microeconomics: Sixth Edition, Prentice Hall: Upper Saddle River, p. 283.

[238] Firms may elect to temporarily sell products below cost. See Section VIII.C.4 for a discussion of why these pricing aberrations are not inconsistent with positive pass-through.

[239] For example, if unskilled labor is a major input in a firm's production, and the wage for unskilled laborers is unaffected by the increase in demand, then the firm can expand without incurring any cost increases. A practical example is if a new retail store opens in a large city, the new entrant pays the same wage as existing retail stores—the prevailing wage for store clerks remains unchanged.

perfectly competitive, the pass-through rate of an industry-wide cost increase is positive;[240] and, when the industry displays constant costs, the pass-through rate is 100%.[241]

Few markets, if any, fit the textbook definition of perfectly competitive; however, pass-through rate of industry-wide cost changes is positive regardless of the degree of competition. To see this, consider the other extreme from perfect competition: a perfect monopoly where there is only a single seller in the market. A monopolist also will increase its price when its costs increase.[242] Most markets are not a perfect monopoly nor are they perfectly competitive: rather they are located between these two extreme market structures. These more common markets are referred to as imperfectly competitive markets. With imperfect competition, the pass-through rate will also be positive. An imperfectly competitive firm recognizes that, when it shifts even a portion of its cost increase forward, the increase in price causes demand for its product to decline. Depending on how responsive demand is to changes in price, an imperfectly competitive firm may find it profitable to shift forward less or more than its cost increase; that is, the pass-through rate may be less than or greater than 100%, respectively.[243,244] In any event, when an

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[240] See, e.g.,

- Bishop, Robert L., May 1968, The Effects of Specific and Ad Valorem Taxes, Quarterly Journal of Economics, Vol. 82(2), pp. 198-218.
- Kosicki, George, and Miles B. Cahill, Fall 2006, Economics of Cost Pass Through and Damages in Indirect Purchaser Antitrust Cases, Antitrust Bulletin, Vol. 51(3), pp. 599-630.

Pass-through is zero under perfect competition in the unrealistic case where demand is perfectly elastic; that is, in cases where demand falls to zero if price increases at all.

[241] Nicholson, Walter, 2005, Microeconomic Theory: Basic Principles and Extensions: Ninth Edition, South-Western: Mason, Ohio, pp. 296-299 and Stiglitz, Joseph E., May 1988, Economics of the Public Sector, 2nd edition, W.W. Norton & Company, p.417.

[242] See, e.g.,

- Bishop, Robert L., May 1968, The Effects of Specific and Ad Valorem Taxes, Quarterly Journal of Economics, Vol. 82(2), pp. 198-218.
- Bulow, Jeremy I., and Paul Pfleiderer, February 1983, A Note on the Effect of Cost Changes on Prices, The Journal of Political Economy, Vol. 91(1), pp. 182-185.

[243] When a firm increases its price in response to a cost increase, there are two effects on profits: (1) the firm's profit on each unit sold changes and (2) the firm sells fewer units. While the second effect always causes the firm's profits to fall, the first effect may cause, by itself, the firm's profit to rise or fall. In either case, the firm's profits fall when costs increase, but the firm mitigates the extent of the profit decline by increasing its price.

Suppose that a firm passes through less than 100% of a cost increase. In that case, its profit on each unit sold declines and it sells fewer units. The loss in sales is smaller than it would be if the firm passed on 100% or more of a cost increase. When the firm is earning economic profits, the firm can account for the higher costs in part by passing some of the cost increase on to consumers and in part by reducing its profit margin. If a firm passes through more than 100% of a cost increase, then it still sells fewer units, but its profit on each unit sold increases. The increase in profits per unit may mitigate the decline in profits caused by the decline in volume sold. The pass-through rate is less than 100% when the change in price reduces quantity sufficiently that it would offset the increase in profits per unit if price rose by more than the cost change. Fullerton, Don and Gilbert E. Metcalf, 2002, Chapter 26: Tax Incidence, in Auerback, A.J. and M. Feldstein (Eds.), Handbook of Public Economics, Vol. 4, Elsevier Science: Amsterdam, p. 1825.

[244] See, e.g.,

industry is imperfectly competitive, the pass-through rate of an industry-wide, non-transitory cost increase is positive,[245] although the pass-through rate may be greater than or less than 100%.[246]

b) Pass-through can be calculated when there are multiple levels of distribution

Pass-through occurs at each stage of the manufacturing and distribution process. For example, suppose there are several stages in the distribution chain: a manufacturer sells to a distributor, the distributor sells to a retailer, and the retailer sells to the end consumer. When the manufacturer faces an industry-wide, non-transitory increase in the cost of inputs, it increases its price. Similarly, when the distributor (and all its competitors) pays a higher price for the product, it also increases its price; this process continues throughout the entire distribution chain. The pass-through rate from the top of the distribution channel to the bottom of the distribution channel, or

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- Anderson, Simon P., de Palma, Andre, and Brent Kreider, 2001, Tax Incidence in Differentiated Product Oligopoly, Journal of Public Economics, Vol. 81, pp. 173-192.
- Besley, Timothy, 1989, Commodity Taxation and Imperfect Competition: A Note on the Effects of Entry, Journal of Public Economics, Vol. 40, pp. 359-367.
- Delipalla, Sophia, and Owen O'Donnell, 2001, Estimating Tax Incidence, Market Power and Market Conduct: The European Cigarette Industry, International Journal of Industrial Organization, Vol. 19, pp. 885-908.
- Karp, Larry S., and Jeffrey M. Perloff, 1989, Estimating Market Structure and Tax Incidence: The Japanese Television Market, Journal of Industrial Economics; Vol. 37(3), 225-239.

[245] Bulow and Pfleiderer show this result for a monopoly. Bulow, Jeremy I., and Paul Pfleiderer, February 1983, A Note on the Effect of Cost Changes on Prices, The Journal of Political Economy, Vol. 91(1), 182-185. Fullerton and Metcalf show this result for oligopolies. Fullerton, Don, and Gilbert E. Metcalf, 2002, Chapter 26: Tax Incidence, in Auerback, A.J., and M. Felstein (Eds.), Handbook of Public Economics, Vol. 4, Elsevier Science: Amsterdam , p. 1823.

[246] Empirical studies have found pass-through rates of less than, greater than, and equal to 100%. For estimates of pass-through rates less than 100%, see, e.g.,

- Balke, N.S., Brown, S.P.A., and M.K. Yucel, 1998, Crude Oil and Gasoline Prices: An Asymmetric Relationship?, Economic Review.
- Duffy-Deno, K.T., 1996, Retail Price Asymmetries in Gasoline Local Markets, Energy Economics, Vol. 18.

For estimates of pass-through rates greater than 100%, see, e.g.,

- Doyle, Maura P., July 1997, The Effects of Interest Rates and Taxes on New Car Prices, Board of Governors of the Federal Reserve System Finance and Economics Discussion Series 1997-38.
- Karp, Larry S., and Jeffrey M. Perloff, 1989, Estimating Market Structure and Tax Incidence: The Japanese Television Market, Journal of Industrial Economics; Vol. 37(3), 225-239.

For estimates of pass-through rates equal to 100%, see, e.g.,

- Bacon, R.W., 1991, Rockets and Feathers: the Asymmetric Speed of Adjustment of UK Retail Gasoline Prices to Cost Changes, Energy Economics, Vol. 13.
- Karp, Larry S., and Jeffrey M. Perloff, 1989, Estimating Market Structure and Tax Incidence: The Japanese Television Market, Journal of Industrial Economics; Vol. 37(3), 225-239.

the "channel-length" pass-through rate, is the product of the pass-through rates for each distribution level.

For example, consider an example where Samsung (SDI), a CRT manufacturer, sells CRTs to BenQ, a company that makes CRT monitors using those same tubes, for $100. BenQ then sells those CRT monitors to Best Buy, a retailer, for $115. Best Buy then sells the monitors to end-users for $120. Now suppose that SDI increases the price it charges BenQ by 10%, resulting in a tube price of $110. Suppose that BenQ in turn increases its price to $130 and that Best Buy increases its price to $135. The pass-through rate for BenQ is 150%[247] and the pass-through rate for Best Buy is 100%.[248] Therefore, the channel-length rate is 150%, which is the product of the two pass-through rates, 150% × 100% = 150%.

One can also measure the impact of the cost increase imposed by SDI on the price paid by final consumers in a single step. Using the same numerical example above, the channel-length pass-through rate can be calculated directly: the change in price to the end user is $15 and the cost increase at the top of the channel is $10;[249] therefore, the channel-length pass-through rate is again 150%, which is $15 divided by $10. Thus, it is not necessary to estimate BenQ's and Best Buy's pass-through rates in order to determine the pass-through rate for a price increase imposed on direct purchasers on to the price that final consumers pay.

The channel-length pass-through rate calculation gives them same result whether it is calculated stage-by-stage or in a single step.

c) The more competitive the industry, the closer the pass-through rate is to 100%

Suppose that an industry is imperfectly competitive, in which case I know the pass-through rate is not equal to 100%, although it could be either above or below 100%. Regardless of whether it was initially above or below 100%, I know that as the degree of competition in the industry increases, the pass-through rate approaches 100%. At the extreme, when the industry achieves perfect competition (and costs are constant), the pass-through rate reaches 100%. The more competitive an industry, the closer the pass-through rate is to 100%.[250]

d) The distribution channel is highly competitive

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[247] Calculated as the change in price ($130 – $115) divided by the change in cost ($110 – $100).

[248] Calculated as the change in price ($135 – $120) divided by the change in cost ($130 – $115).

[249] The end consumer price for the CRT monitor increased from $115 to $130. Direct purchasers buy tubes which are used to make CRT products; the tube costs increased from $100 to $110.

[250] See, e.g.,

- Benigno, Pierpaolo, and Ester Faia, March 2010, Globalization, Pass-Through and Inflation Dynamic, NBER Working Paper 15842, http://www.nber.org/papers/w15842.
- Verboven, Frank, and Theon vanDuk, September 2009, Cartel Damages Claims and the Passing-On Defense, The Journal of Industrial Economics, Vol. 57(3), pp. 457-491.
- Werden, Gregory J., Luke M. Froeb, and Steven Tschantz, October 2005, The Effects of Merger Efficiencies on Consumers of Differentiated Products, European Competition Journal, Vol. 1(2), pp. 245-264.

As described above (see Section VI.D and Exhibit 11), there are multiple steps in the distribution of CRTs to class members. As each of these levels becomes more competitive, the pass-through rate at each level approaches 100% and, therefore, the channel-length pass-through rate also approaches 100%. The documentary evidence, from a variety of sources, indicates that each of the distribution levels for monitors and TVs is highly competitive.[251]

There are a large number of firms involved in the production and the distribution of CRT products, which is one indicator of intense competition. There are at least 28 brands of CRT monitors, and at least 29 brands of CRT TVs.[252] Exhibits 25-26 present market shares for each of the monitor and TV brands.

Intense competition is also evidenced by the lack of concentration among the sellers of CRT products. As explained in Section VI.C.1 above, HHIs are used to measure the degree of concentration. Lower HHI values indicate a less concentrated market and, hence, more competitive conditions for market participants. [redacted]

Intense competition also leads to low profit rates, which is also a characteristic of the production and distribution of CRT products. See Exhibit 27.

The trade press reports a high degree of competition in the production, distribution, and sales of CRT products. The firms that produce and distribute CRT products routinely report intense competition. [redacted]

2. Documentary evidence shows that market participants recognize that CRT price changes are passed through

[redacted]

[251] That the CRT product manufacturing industry is highly competitive is not inconsistent with Plaintiffs' claims that Defendants fixed the price of CRTs and CRT products. By fixing the price of CRTs, the Defendants in effect are fixing the price of products, because product prices are a function of CRT prices; an increase in the price of CRTs leads to an increase in the price of CRT products, as discussed in Section VIII.C.1.

[252] These numbers are a lower bound because the data contain an "other" category that includes more, smaller, brands.

[redacted]

[redacted]

3. Pass-through is always greater than 100% when firms use "cost-plus" pricing rules

Under certain conditions, I can make reliable conclusions about the magnitude of the pass-through rate based on a firm's pricing policies. Specifically, if a firm uses cost-plus pricing,[255] its pass-through rate is at least 100%. For certain types of demand, using a cost-plus rule is the profit-maximizing pricing strategy.[256]

In the case of cost-plus pricing in percentage terms, the pass-through rate is equal to the mark-up rate and is always greater than 100%. For example, suppose that a firm always marks costs up by 20%; if costs are $100, then the firm sets price at $120. When costs increase by $1, price will increase by $1.20 (= $1 × 120%), and thus the pass-through rate is equal to 120% (= change in

[redacted]

[255] Cost-plus pricing is the practice of applying a certain markup above cost to set price.

[256] This is true if a firm faces a demand curve with constant elasticity of demand. Although price elasticity varies along most demand curves, it is the same at every point along a constant elasticity demand curve. In lay terms, this means that given a 1% increase in price—regardless of whether the starting price is at a high level or a low level—the quantity demanded will decline by the same percentage. Bulow, Jeremy I., and Paul Pfleiderer, February 1983, A Note on the Effect of Cost Changes on Prices, The Journal of Political Economy, Vol. 91(1), 182-185, p. 183.

price / change in cost = $1 / $1.20). Now consider a firm that uses cost-plus pricing in dollar terms. For example, suppose that a firm always sets price by adding $40 to its costs. If costs are $100, the firm sets a price of $140. If costs increase to $101, the firm increases its price to $141. In the case of cost-plus pricing in dollar terms, the pass-through rate will always be equal to 100% (= change in cost / change in price = $1 / $1).

[redacted] To the extent that resellers follow these pricing policies, I can infer that a reliable estimate of the pass-through rate is at least 100%.

4. Pass-through is consistent with different prices, promotional pricing strategies, and focal point pricing strategies

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

- "That markup of nearly 50% of the total cost is a 'healthy profit margin' for Amazon, said Van Baker, a Gartner Inc. analyst, adding that most consumer products have markups of 20% to 25% of total cost. 'A markup of 50% of total cost is almost impossible to do in consumer electronics just because the market is so competitive'." Matt Hamblen, 22 April 2009, Material costs for Kindle 2 are about half its retail price, ComputerWorld, http://www.computerworld.com/s/article/9131974/Materials_costs_for_Kindle_2_are_about_half_its_retail_price_, accessed 14 September 2012, p. 1.

The pass-through rate gives the change in price given a change in cost; it is not directly a function of the price level and its existence is fully consistent with a variety of pricing practices that may be present in the distribution of CRT and CRT products. Specifically, pass-through occurs even when there is price variation across firms and/or products, loss-leader and discount pricing, and focal point pricing.

a) Different price levels are consistent with pass-through

CRTs with the same specifications (or CRT products with the same specifications) may be sold at different prices by different resellers; however, the fact that prices are not the same does not indicate that pass-through differs—or does not occur at all—for these products. While the products may be sold at different prices, they are sold in distribution channels that are highly competitive and, therefore, the pass-through rate will be similar across firms and will be close to 100%.[258]

In general, although two different firms may be selling a CRT product with the same specifications, from the consumer's perspective they are typically not selling the identical product because firms do more than merely hand over merchandise to purchasers. For example, different retailers provide different levels of customer service, product information, return policies, installation support, pre- and post-purchase consultation, repairs, and store warranties. Different retailers may experience different rental expenses based on the desirability and convenience of their store locations. Some retailers do not advertise at all, while others provide consumers with information pertaining to products available, prices, performance, and store locations. Some retailers operate only online, in which case shipping costs become relevant to the consumer for both the purchase and potential return. The price of the products offered by a retailer in a competitive distribution market reflect all of the costs incurred by the retailer; in turn, the price of the product bundled together with other services, only some of which are described above, will vary among retailers.

The following example illustrates that pass-through is consistent with different prices across retailers. Suppose that retailer A runs a no-frills operation and has cost of $100 for a CRT monitor plus $5 per sale in processing costs; intense competition leads retailer A to charge $105. Retailer B runs a high-status, full-service operation, and has costs of $100 for the same CRT monitor, $10 per sale in processing costs, and $10 per sale in customer service; intense competition leads retailer B to charge $120. Thus, the same CRT monitor is available for $105 from retailer A and for $120 from retailer B. Now suppose that the cost for the CRT monitor increases to both retailers from $100 to $110. Retailer A will raise its price to $115 and retailer B will raise its price to $130. The price for the same CRT monitor is higher at retailer B, before and after the increase in the cost of the CRT, and both firms have 100% pass-through.

Prices may also vary across CRTs and CRT products, even at the same distribution firm. For example, graphics quality is superior on high definition TVs compared to standard definition TVs. Based on the superior graphics, the market price for high definition TVs will be higher than for standard definition TVs that are otherwise identical.[259] Regardless of the fact that these

[258] I discuss the effects of competition on the pass-through rate in Section VIII.C.1.

[259] See, e.g.,

[redacted]

products are differentiated across some specifications and sold at differing prices, pass-through still occurs. Further, because these products are sold in competitive distribution channels, the pass-through rate is expected to be close to 100%. There is nothing inconsistent between the pass-through of overcharges and product differentiation.

Consider a variation on the earlier numerical example. Suppose that no-frills retailer A sells a standard definition CRT TV model X and a high definition CRT TV model Y. Suppose A pays $300 for the standard definition CRT TV and $400 for the high definition CRT TV. Retailer A also bears other processing costs of $5 for either the standard definition or the high definition CRT TV. Due to intense competition, retailer A sets price to cover its total costs, and prices the standard definition TV model X at $305 and high definition TV model Y at $405. Now the price of each CRT TV increases. Suppose the cost of CRT TV model X increases to $310 and the price of CRT TV model Y increases to $417. Retailer A again sets price to cover its full costs, so prices X at $315 and Y at $422. In both cases, retailer A has fully passed on its cost increases. In one case cost increased by $10, as did price; in the other cost increased by $17, as did prices.

The methods that I describe in Section IX.B can be applied to a situation where the price for the same CRT or CRT product differs across sellers and/or the price for different CRTs or CRT products varies with their characteristics.

b) Loss-leader and other discount pricing is consistent with pass-through

Firms sometimes engage in a variety of pricing techniques to attract customers, including offering discounts (sales) and rebates or using loss-leaders.[260] These pricing techniques are simply different forms of marketing expenditure: a reseller incurs a cost in the form of reduced sales revenue in order to entice consumers to purchase its other products. A firm that chooses to incur these marketing expenditures in the actual world would have the same incentive to incur these expenditures in the but-for world in which no price-fixing conspiracy existed. In the but-for world, the only difference would be that the firms' original costs were lower absent the alleged overcharge.

The following example illustrates this point. Suppose retailer A has costs of $300 for a TV, and $5 in per sale processing costs. Assuming a competitive environment, it will sell the TV for $305. Suppose retailer A decides to incur a $10 marketing cost per sale in the form of a sale price, which results in the TV being sold for $295 (below its cost). Now consider a world in which the cost for the same TV to retailer A is $260 instead of $300. Assuming the retailer passes through 100% of its cost change and still incurs the same marketing cost, the resulting price is $255. In this example, the retailer is still spending $10 per unit on marketing (it has product and processing costs of $265, which are discounted by $10 as a marketing strategy). The retailer is making the same per-unit profit, which is negative $5 (the expectation is that the reseller will make up this loss on the sale of other more profitable sales, either during the same visit or sometime in the future). In this example, the retailer has passed-through 100% of the reduced TV price: the cost to the retailer was reduced by $40, the same amount by which the

[redacted]

[260] The term loss-leader refers to an item being sold at a discounted price, sometimes at or even below cost. The purpose of this pricing practice is to attract customers, which will increase sales on other, more profitable items. Loss-leaders are essentially temporary sales promotions.

price to the consumer was reduced. In this manner, it is evident that incurring marketing costs in the form of discounts or sale prices is unrelated to whether input costs are being passed through, and 100% pass-through of the (savings from the) eliminated overcharge is completely feasible even if the firm is "selling at a loss".[261]

c) Focal point pricing is consistent with pass-through

Focal point pricing is the tendency for firms to set prices at specific price points, which usually end in "9", such as $99. The adoption of this pricing strategy does not prevent the pass-through of overcharges. First, a reseller can pass through cost changes while still using focal point pricing. Second, quality adjustments can be made to offset cost changes, so that the original focal price can be kept. In either event, the result remains that the overcharge is passed through to the buyer.

Suppose that a firm that uses focal point pricing faces a cost increase. The reseller can simply increase the price to a higher focal point. Suppose a TV OEM sells a TV that includes a CRT tube for $399, and that the cost of the tube increases from $60 to $90. The TV OEM could increase the price of the TV from $399 to $429 to compensate for the $30 cost increase. As this example shows, there is nothing inconsistent between focal point pricing and the pass-through of overcharges.

D. Summary: There is common impact on class members

I find that the cartel effectively increased price and that the increase in price was common to direct purchasers. Furthermore, based on economic theory and the documentary evidence, I find that the price increase to direct purchasers is passed through to indirect purchasers. Thus, class members suffered common impact. The analyses that support my conclusion are based on common evidence and are applicable to all class members. The analyses are not dependent on which type of CRT product was purchased, who purchased the CRT, from whom the product was purchased, nor when the product was purchased.

IX. Damages from overcharges are capable of proof at trial through evidence and methods common to the class

Class members did not directly purchase CRTs from Defendants but rather purchased CRT products such as monitors or TVs that incorporated CRTs manufactured by Defendants. One method for measuring the antitrust damages to indirect purchasers is to first measure the antitrust overcharge imposed by Defendants on direct purchasers and to then measure the portion of that direct overcharge that was passed down the distribution chain to members of the class. In this section I describe several formulaic methods for measuring the overcharge on direct purchasers.

A. Measurement of the antitrust overcharges to direct purchasers is susceptible to common proof

Defendants imposed an overcharge on a direct purchaser if, as a result of Defendants' conspiracy, the price that the direct purchaser paid was above what the direct purchaser would have paid absent the cartel. Consequently, the amount of the antitrust overcharge to any direct purchaser can be quantified by subtracting the price that the direct purchaser would have paid but for the cartel – the "but-for price" – from the actual price paid by the direct purchaser.

[261] This is true for any positive pass-through rate.

Because Defendants colluded, the but-for world in which they set prices independently did not exist. As a result, measuring the overcharge to direct purchasers necessarily involves making predictions regarding outcomes that would have occurred had Defendants not engaged in collusive conduct.[262] There are at least four sources from which a reasonable measure of the but-for price can be obtained. First, a measure of the but-for CRT price can be obtained from an analysis of how CRT prices are related to demand and supply conditions in the CRT market when there is no collusive conduct. Second, the but-for CRT price can be calculated as the price that would have afforded Defendants the same profit margin that firms operating in industries that faced demand and cost structures similar to the CRT industry but that were not cartelized were able to earn. Third, an economic model that integrates the characteristics of the CRT industry can be used to calculate the price that would have maximized Defendants' profits if they had acted independently. A fourth reasonable basis is an estimate of the reduction in Defendants' market power had they behaved independently rather than collusively.

Empirical and qualitative information are important determinants of the model or models most appropriate for this case.[263] Both types of information will continue to become available through research and discovery. While I have not, at this stage of the proceedings, conducted a full and complete review of all data produced or expected to be produced, I describe four formulaic approaches to estimating the but-for price of Defendants' CRTs using evidence that is common across the class and for which I have engaged in sufficient investigation to assure myself that such data are likely to be available to allow the method to be implemented.

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[262] See, e.g.,

- "Proving as a fact something that never occurred ('what the plaintiff's situation would have been in the absence of the defendant's antitrust violation') is impossible. Resort to assumptions and inferences, supported by real-world data, evidence, and economic theory, is inevitable." American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago, p. 56.
- "Quantifying damages involves estimating the price that would have occurred absent the cartel during the period of the cartel. Clearly, the price we need is not and never will be observable so that the exercise will always rely on assumptions and a certain degree of speculation." Davis, Peter and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton, p. 352.

[263] See, e.g.,

- Additional data can help improve the precision of the estimate of a particular variable's impact on the dependent variable as well as improving the power of statistical tests. Kennedy, Peter, 26 February 2008, A Guide to Econometrics, 6th Edition, Wiley-Blackwell: Malden, pp. 194-197.
- "Which methodology to use will be a matter of judgment by the economist on a case team, ideally informed by her colleagues about such things as potentially appropriate natural experiments. The best method will greatly depend on the details of the case, the data available, and the question(s) which must be answered." Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton, p. 556.
- "[I]n antitrust enforcement it is often possible, as well as highly beneficial, to use documents and deposition or oral testimony to confirm the specification of the model being utilized in an empirical study. To do so requires an appropriate mix of historical data, hypotheticals, and assumptions about behavior based on qualitative techniques." Baker, Jonathan B., and Daniel L. Rubinfeld, 1999, Empirical Methods in Antitrust Litigation: Review and Critique, American Law and Economics Review, Vol. 1, No. 1, 386-435, p. 431.

For each approach to estimating the but-for price, I describe the commonality across class members of the economic model useful for measuring the but-for price, the data requirements to fit the model to the CRT industry, and the likely availability of such data in the present case.

1. Economic determinants method: Measurement of overcharges based on competitively-determined prices

Prices and quantities are determined by the demand, cost, and competitive conditions present in an industry. One basis for determining the price that Defendants would have charged for CRTs if they had set prices independently is to quantify the relationship between prices and the demand, cost, and competitive conditions in the CRT industry using market data from periods subject to and not subject to price-fixing.[264] Economists often use regression analysis to quantify the relationship between multiple variables in order to explain or predict an outcome of interest.[265] In the present case, regression analysis can be implemented using data from the CRT industry to understand how the price of a CRT is impacted by the presence of the cartel independently of the impact on price by demand, cost, and market structure variables that are not affected by the cartel.

One implementation of the regression method is to estimate a "reduced-form" price equation.[266] Specifically, the pricing equation to be estimated would have CRT price as the dependent variable on the left-hand side of the equation, and demand and cost variables unaffected by the conspiracy as well as a measure of the market structure as the independent variables on the right-

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[264] This method is often called a before-and-after method. See, e.g.,

- American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago.
- Connor, John M., February 2001, Our Customers Are Our Enemies: The Lysine Cartel of 1992-1995, Review of Industrial Organization, Vol. 18(1), pp. 5-21.
- Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton.

[265] Regression analysis is routinely used by economists and has been accepted by the courts. For example, all graduate programs in economics require coursework in econometrics, which is essentially the application of regression analysis to economic issues. Regarding the use of regression analysis by the courts, see, e.g.,

- "Multiple regression and other econometric methods have been used frequently in cases brought by the competition authorities and in private litigation." Rubinfeld, Daniel L., 2008, Quantitative Methods, in Antitrust, in American Bar Association (Eds.), Competition Law and Policy, Section of Antitrust Law, Issue 1, ABA Publishing: Chicago, 723-742, p. 723.
- "The legal requirements for regression analysis fall under the rules for testimony by experts...Regression analyses have met these requirements many times in litigation for a wide range of issues, including the estimation of antitrust damages." American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago, pp. 128-129.
- Rubinfeld, Daniel L., 2000, Reference Guide on Multiple Regression, in Federal Judicial Center, and National Research Council (Eds.), Reference Manual on Scientific Evidence, Third Edition, National Academies Press: Washington, D.C., 303-358.

[266] "A 'reduced form' model is a single equation that describes prices (the dependent variable) as a function of various exogenous factors thought to influence supply and demand (such as costs, prices of substitutes, etc.)." American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago, p. 201.

hand side of the equation.[267] An indicator variable on the right-hand side of the equation would be used to indicate whether the observations of price, cost, and demand are from a period in which the cartel was active or not.[268] Finally measures of the market structure such as the number of firms in the industry and industry concentration levels may be added.[269]

Defendants are alleged to have engaged in a price-fixing conspiracy from at least March 1, 1995 until at least November 25, 2007.[270] Data observations falling within this time frame would be included as part of the "cartel period" in the regression. Data observations outside of this period provide information regarding price determination in the absence of the cartel.

In the purest implementation of the method, transactions from outside of the cartel period would be free of any collusive impact. However, it is possible that transactions from outside the alleged class period were impacted by the cartel. For example, if some degree of communications between some CRT manufacturers occurred before March 1, 1995, prices prior to the class period could include some artificial inflation.[271] Likewise, prices may remain at inflated levels after a cartel ceases to explicitly communicate because firms are able to implicitly coordinate behavior or because of cartel members' incentive to keep prices high to reduce their expected damages.[272] If the period outside of the cartel includes some prices that were impacted by the

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[267] "The most common statistical method employed in antitrust litigation involves the estimation of 'reduced-form' price equations. A typical reduced-form model might explain the variation in the price of a product as a function of a series of variables relating to cost, demand, and market structure." Rubinfeld, Daniel L., 2008, Quantitative Methods, in Antitrust, in American Bar Association (Eds.), Competition Law and Policy, Section of Antitrust Law, Issue 1, ABA Publishing: Chicago, 723-742, p. 724.

[268] An indicator variable is equal to one if the condition is present and zero otherwise. These variables are also sometimes called "dummy" variables. "The dummy variable approach is appealing because it can be applied even where there is a relative paucity of data in the nonconspiratorial period." Rubinfeld, Daniel L., 2008, Quantitative Methods, in Antitrust, in American Bar Association (Eds.), Competition Law and Policy, Section of Antitrust Law, Issue 1, ABA Publishing: Chicago, 723-742, p. 740.

[269] See, e.g.,

- "Market *structure* consists of those factors that determine the competitiveness of a market. Market structure affects market performance through the *conduct* or behavior of firms." Carlton, Dennis W., and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Person Addison Wesley, p. 244, emphasis in original.
- "[V]ariables related to market structure may appear in the reduced-form price equation because they reflect the extent to which the firms are able to exercise market power." Rubinfeld, Daniel L., 2008, Quantitative Methods, in Antitrust, in American Bar Association (Eds.), Competition Law and Policy, Section of Antitrust Law, Issue 1, ABA Publishing: Chicago, 723-742, p. 726.

[270] Complaint, ¶1.

[271] The complaint suggests the possibility of some limited information exchanges amongst Defendants prior to the start of the class period. "In the early 1990s, representatives from Samsung, Daewoo, Chunghwa and Orion visited each other's factories in S.E. Asia. During this period, these producers began to include discussions about price in their meetings. The pricing discussions were usually limited, however, to exchanges of the range of prices that each competitor had quoted to specific customers." Complaint, ¶133.

[272] See, e.g.,

- Connor, John M., February 2001, Our Customers Are Our Enemies: The Lysine Cartel of 1992-1995, Review of Industrial Organization, Vol. 18(1), pp. 5-21.

cartel, then this method will be conservative in that it will understate the impact of the cartel on prices and thus understate the overcharge to direct purchasers.

[redacted]

The right-hand side of the reduced-form price equation includes variables that control for the non-cartel determinants of prices. Factors that control for the effect of consumer demand on prices include income and the prices of related goods. Available measures of income include publicly available data on U.S. personal income, U.S. GDP, and U.S. employment data.[273] Other measures related to demand are also publicly available. For example, the World Bank's Global Economic Monitor data series include information on global economic activity.[274]

Cost variables that are typically used in a reduced-form price equation include costs of raw materials and labor. [redacted] Measures of raw material costs are also

- Harrington, Joseph E. Jr., December 2004, Post-Cartel Pricing During Litigation, The Journal of Industrial Economics, Vol. 52(4), pp. 517-533.

[273] See e.g.,

- The Bureau of Economic Analysis provides data on total personal income for the U.S. Bureau of Economic Analysis, Undated, Table 2.1 Personal Income and Its Disposition, http://www.bea.gov/iTable/print.cfm?fid=631897CBF123A3CCA6F9F71B6A275E842AA969E308E74F2936D143BC69BC3545ECCA4DCB961F5A49C1F1068066A32C234F923A965C2312F52A30F6C9A18A218F, accessed 17 September 2012.
- The Bureau of Economic Analysis provides data on the GDP for the U.S. Bureau of Economic Analysis, 29 August 2012, Table 1.1.5 Gross Domestic Product, http://www.bea.gov/iTable/print.cfm?fid=547158F133824F0E271ED75AEE6081FEA3042E3C4B0FA3B6C7D755CEAF2B26B2DD7F907C33DDA1576C3AAE02E586FBB5371F86EAFBBFCAC88288F0A08D75C9DDF, accessed 17 September 2012.
- The Bureau of Labor Statistics provides employment data for the U.S. U.S. Department of Labor, Bureau of Labor Statistics, Undated, Labor Force Statistics from the Current Population Survey, http://data.bls.gov/pdq/querytool.jsp?survey=ln, accessed 17 September 2012.

[274] The World Bank provides data on the world GDP, world GDP per capita, gross national expenditure, and household final consumption expenditure. The World Bank, Undated, World Development Indicators and Global Development Finance, http://databank.worldbank.org/Data/Views/VariableSelection/SelectVariables.aspx?source=World%20Development%20Indicators%20and%20Global%20Development%20Finance, accessed 17 September 2012.

[redacted]

available from public data sources.[276] [redacted] and publicly available data sources.[278] Additional data that can be included in the

- [redacted]

[276] See, e.g.,

- The World Bank provides petroleum and natural gas price series. The World Bank, 07 September 2012, World Bank Commodity Price Data (Pink Sheet), http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1304428586133/PINK_DATA.xlsx, accessed 17 September 2012.
- The Bureau of Labor Statistics provides a Producer Price Index for machine-made pressed and blown glass and glassware. U.S. Department of Labor, Bureau of Labor Statistics, Undated, Producer Price Index Industry Data Machine-made pressed and blown lighting, automotive, and electronic glassware, http://data.bls.gov/pdq/querytool.jsp?survey=pc, accessed 18 September 2012.

[277] See e.g.,

- [redacted]

regression analysis to account for supply-side factors outside of the control of the cartel include, for example, publicly available data on interest rates, which provide a proxy for the opportunity cost of capital.[279]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[278] See e.g.,

- Information on China's manufacturing wages is available from Banister, Judith, August 2005, Manufacturing Earnings and Compensation in China, http://www.bls.gov/opub/mlr/2005/08/art3full.pdf, accessed 10 September 2012, p. 35.
- Labor costs per employee for the manufacturing industry for Germany, Japan, Korea, and the United States are available from OECD.StatExtracts, Undated, Unit Labour Costs - Annual Indicators; Labour Compensation per Employee/Hour ($US PPP adjusted), http://stats.oecd.org/Index.aspx?queryname=430&querytype=view#, accessed 10 September 2012 at 2.
- This document provides hourly compensation costs for production workers in computer and electronic product manufacturing in Mexico. U.S. Department of Labor, Bureau of Labor Statistics, 19 May 2006, Hourly Compensation Costs for Production Workers in Manufacturing Industries Mexico, 1975-2004, ftp://ftp.bls.gov/pub/special.requests/foreignlabor/flsmexmaq.txt, accessed 17 September 2012, pp. 12-13.

[279] See, e.g.,

- The Federal Reserve provides U.S. interest rates. Federal Reserve, 12 September 2012, H.15 Selected Interest Rates, http://www.federalreserve.gov/datadownload/Build.aspx?rel=H15, accessed 20 September 2012.
- The Bank of Korea provides Korean interest rates. The Bank of Korea, Undated, ECOS Economic Statistics System, http://ecos.bok.or.kr/EIndex_en.jsp, accessed 20 September 2012.
- The Bank of Japan provides Japanese interest rates. Bank of Japan, Undated, Bank of Japan Statistics, http://www.boj.or.jp/en/statistics/index.htm/, accessed 20 September 2012.
- The Bank of Mexico provides Mexican interest rates. Banco de Mexico, Undated, Banco de Mexico Statistics, http://www.banxico.org.mx/estadisticas/statistics.html, accessed 20 September 2012.
- The World Bank provides interest rates for China, Germany, Malaysia, Thailand, and India. World Bank, Undated, World dataBank, http://databank.worldbank.org/ddp/home.do, accessed 20 September 2012.

Once the pricing equation has been estimated from the data, the coefficient on the cartel indicator variable – which isolates the impact of the cartel on CRT prices from changes in prices due to changes in demand, cost, and competitive conditions – can be used to adjust the observed cartel price during the damages period to obtain the but-for CRT price.

The reduced-form regression analysis is a widely used method that can be implemented to quantify the impact of the cartel while controlling for the influence of demand, costs, and market structure on prices. The reduced-form regression formula is common across members of the class. Additionally, the data to implement this method are available to all class members. Consequently, the regression analysis provides a formulaic method, based on data common to members of the class, for measuring the direct overcharge.

2. Benchmark comparisons method: Measurement of overcharges based on a benchmark product

Another basis for the but-for price is to identify an industry that faced similar demand and cost structures as those that were present in the CRT industry but that was not cartelized. Market outcomes in this industry could then substitute – or "proxy" – for the outcomes that would have occurred in the CRT industry absent the cartel. Such a proxy is called a benchmark. Because the two markets are similar to one another except for the collusion in the CRT market, differences between economic outcomes in the benchmark market and the CRT market provide a measure of the impact of collusion on the CRT market. I now describe benchmark products that provide a reasonable basis for measuring the overcharge due to the cartel.

a) Reasonable CRT benchmark products

Two electronics products that do possess characteristics that make them potentially reasonable benchmarks for the but-for world in the present case are VHS recorders and portable CD players. Like CRTs, both of these products exhibit scale sensitive manufacturing, are precision electronic devices, and were replaced by alternative technologies – VHS recorders were replaced by DVR recorders and portable CD players by hard drive and flash memory digital music players such as the iPod. Also like CRTs, the declining demand in both industries was foreseeable by both consumers and manufacturers. As a result, consumer considerations such as whether to buy a new version of the current technology or wait and purchase the emerging technology were likely to have been similar between the CRT industry and the benchmark industries. Similarly, manufacturers in all three of these industries had to make production and sales decisions regarding the current technologies with the knowledge that demand for these products were being replaced by demand for the emerging technologies.

Moreover, in addition to sharing an economic environment marked by declining demand due to new technologies, CRTs, VHS recorders, and personal CD players also shared common manufacturers. For instance, Panasonic, Philips, and Samsung manufactured both VHS recorders and personal CD players; Thomson manufactured personal CD players; and Daewoo, Goldstar (LG), Hitachi, Tatung, and Toshiba manufactured VHS recorders. When the same firms produced both the benchmark products and CRTs, company-specific management skill and name recognition are held constant. Any differences in market outcomes are more likely to represent the impact of the cartel than the impact of other differences between the benchmark and CRT industries. Additionally, the data available for each market are likely to overlap substantially since they will originate from the same firm.

b) Profitability estimates

Absent collusion, the cartel members' profits would have been subject to additional competitive restraints. A measure of by how much collusion increased cartel members' profits can be obtained by comparing the profits of the benchmark product to the profits of cartel members.[280] Two measures of profits that are used by economists are rates of return – which measure the return on resources invested in a project (or line of business), and price-cost margins – which measure the ability to price above cost.[281] Estimates of the internal rate of return (IRR) can be obtained from asset cost and revenue data and is regularly calculated by firms.[282] Price-cost margins also can be calculated from financial data kept in the ordinary course of business. For example, average variable costs can be calculated from accounting data (e.g., labor and materials costs) and used to obtain an estimate of the marginal cost.[283] Section IX.2 describes data sources collected thus far that can be used to calculate the IRR and price-cost margins for CRTs. Given Defendants track such information for CRTs, it is likely that they also have similar data for their production of benchmark products. In addition, VHS and personal CD player industry data are also available from market research firms.[284]

[280] The data used to calculate profits are typically obtained from financial reports that contain accounting measures of revenue and costs, which may differ from economic revenues and costs. Nonetheless, accounting data can be adjusted to provide measures of economic profits. See, e.g.,

- "[I]t has been established in the literature that there is a theoretical link between IRR and accounting rates of profitability, and hence that accounting data can be used in a meaningful way to assess the IRR." OXERA, July 2003, Assessing Profitability in Competition Policy Analysis, Office of Fair Trading, Economic Discussion Paper 6, p. 41.
- "The basis for measuring economic damages should be economic profit, but analysts are often limited by available data and must use accounting data to estimate damages. Fortunately, accounting data often can be adjusted to produce an estimate of true lost economic profits." American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago, p. 99.

[281] See, e.g.,

- Carlton, Dennis W., and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Person Addison Wesley, p. 247
- "From an economic point of view, the profitability of an activity can be defined in terms of net increases in value resulting from that activity and realised over time. The IRR [internal rate of return] and NPV [net present value] are two commonly accepted and well-established methods for measuring the profitability of an activity." OXERA, July 2003, Assessing Profitability in Competition Policy Analysis, Office of Fair Trading, Economic Discussion Paper 6, p. 9.

[282] Results of a large scale survey of chief financial officers (CFOs) indicate that the internal rate of return is "always" or "almost always" calculated as part of the capital budgeting process of over 75% of CFOs. Graham, John R., and Campbell R. Harvey, 2001, The Theory and Practice of Corporate Finance: Evidence From the Field, Journal of Financial Economics, Vol. 61, p. 6.

[283] I describe in more detail in Section IX.3.b) why declining demand and limited alternative uses of CRT production equipment and facilities make average variable costs a reasonable measure of marginal costs for this particular industry.

[284] The industry research firm NPD Group, for example, lists "Personal CD Players" and "Video Cassette Recorder/Player" as two categories for which data are available. NPD Group, Undated, Consumer Technology Market Research, https://www.npd.com/wps/portal/npd/us/industry-expertise/technology/consumer-technology/, accessed 21 September 2012.

Using the appropriate algebra, both the IRR and the price-cost margin formulas can be solved in terms of price so that the but-for price can be obtained from either the but-for IRR or the but-for price-cost margin.

The benchmark is based on a comparison of market-level characteristics and therefore serves as a benchmark for the CRT industry as a whole. Additionally, each candidate profitability formula from which Defendants' but-for prices are calculated is common across the class. Thus, this method provides a common method based on common evidence with which to measure to the overcharge imposed on direct purchasers.

3. Simulation method: Measurement of overcharges based on a model of the but-for CRT industry

The economic impact of collusion on competition and prices is analogous to that of a merger – firms that previously competed against each other without regard for how their own behavior impacted the profits of their competitors (for instance, without concern that lowering their own price may reduce their competitors' profits) begin to make decisions in such a way as to maximize collective rather than individual profits.[285] Economists have developed formulaic models that integrate consumer demand, cost conditions, and firm interaction in order to analyze the likely price outcomes following a merger;[286] this same approach can be applied using data from the CRT industry to calculate the effect of the cartel on CRT prices.

This method can be used to calculate but-for prices based on information and data on consumer demand, production costs, and firm behavior. I now describe in more detail each of the components of such a model and explain how the model can combined with data from the CRT industry to compute the but-for prices.

a) Demand models

All firms, be they operating in a monopolistic or perfectly competitive market, are constrained in their pricing behavior by consumers' willingness to pay for their goods or services.[287] In

[285] Baker, Jonathan B., and Timothy F. Bresnahan, June 1985, The Gains from Merger or Collusion in Product-Differentiated Industries, Journal of Industrial Economics, Vol. 33, Issue 4, A Symposium on Oligopoly, Competition and Welfare, 427-444.

[286] These models are generally known as "merger simulation" models as they combine economic theory with data from the industry to simulate the price outcomes that would result were firms that were previously independent to merge. See, e.g.,

- Werden, Gregory J., and Luke M. Froeb, October 1994, The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy, Journal of Law, Economics, & Organization, Vol. 10(2), pp. 407-426.
- Epstein, Roy J., and Daniel L. Rubinfeld, March 2004, Merger Simulation with Brand-Level Margin Data: extending PCAIDS with Nests, Advances in Economic Analysis & Policy, Vol. 4(1), Article 2.
- U.S. Department of Justice and Federal Trade Commission, 19 August 2010, 2010 Horizontal Merger Guidelines.
- Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton.

[287] "Company revenues depend on the preferences of consumers and so necessarily demand is a fundamental element in shaping market outcomes." Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton, p. 436.

particular, firms must balance the desire to charge higher prices against the loss of sales due to the higher prices. The elasticity of demand that a firm or (group of firms) faces is a key determinant of the ability to exercise market power.[288] Demand models provide mathematical equations to quantify how much consumers are likely to change the amount of a good they purchase in response to a price change – which economists refer to as the elasticity of demand.[289]

Economists have developed a variety of methods to measure consumer demand.[290] Economists have, for example, estimated the elasticities of demand for individual models of personal computers (PCs) – an industry which, like the CRT industry, regularly experiences the release of new models and whose products are differentiated by attributes for which more is better (e.g., processor speed and memory in PCs and screen size for CRTs) using data on prices, market shares, and product attributes.[291] Industry and firm specific demand elasticities for differentiated products can be estimated using data on quantities, prices, and product characteristics.[292] Exhibit

[288] See, e.g.,

- "Whether the force of demand substitution is sufficient to prevent the exercise of market power depends in part on the extent to which consumers will substitute away in the event prices were to rise (the own elasticity of demand)." Baker, Jonathan B. and Daniel L. Rubinfeld, 1999, Empirical Methods in Antitrust Litigation: Review and Critique, American Law and Economics Review, Vol. 1, No. 1, p. 405.
- "To prove or disprove market power, economists now commonly estimate demand elasticities, and recent cases suggest that courts will rely on such evidence." Werden, Gregory J., 1998, Demand Elasticities in Antitrust Analysis, Antitrust Law Journal, Vol. 66, 363-414, p. 380.
- "It is impossible to quantify the likelihood or the effect of a change in firm behavior if we do not have information about the potential response of its customers." Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton, p. 1.

[289] More formally, the "own-price elasticity of demand" is the percentage change in the quantity demanded divided by the percentage change in the price; the slightly shorter terminologies "elasticity of demand" or "demand elasticity" are typically used.

[290] See, e.g.,

- Baker, Jonathan B., and Timothy F. Bresnahan, June 1985, The Gains from Merger or Collusion in Product-Differentiated Industries, Journal of Industrial Economics, Vol. 33, Issue 4, A Symposium on Oligopoly, Competition and Welfare, 427-444.
- Baker, Jonathan B., and Timothy F. Bresnahan, November 1987, Estimating the Residual Demand Curve Facing a Single Firm, International Journal of Industrial Organization, Vol. 6, 283-300.
- Stavins, Joanna, 1997, Estimating Demand Elasticities in a Differentiated Product Industry: The Personal Computer Market, Journal of Economics and Business, Vol. 49(4), 347-367.
- Werden, Gregory J., 1998, Demand Elasticities in Antitrust Analysis, Antitrust Law Journal, Vol. 66, 363-414.
- "Information about the extent and nature of demand substitution can be obtained in multiple ways, not all quantitative…The wide range of techniques available increases the prospects for obtaining quantitative information on consumers' demand for the product or products at issue in antitrust litigation." Baker, Jonathan B., and Daniel L. Rubinfeld, 1999, Empirical methods in antitrust litigation: review and critique, American Law and Economics Review, Vol. 1, No. 1, 386–435, p. 406.

[291] Stavins, Joanna, 1997, Estimating Demand Elasticities in a Differentiated Product Industry: The Personal Computer Market, Journal of Economics and Business, Vol. 49(4), 347-367.

[292] See, for e.g.,

13 details the data produced by Defendants at present that contain information on CRT prices, quantities, and product characteristics.

b) Costs

In addition to demand, costs play a role in firm behavior. Specifically, to maximize profits, a firm will produce such that the revenue the firm would receive if it produced one more unit would just equal its cost from producing that unit.[293] That is, profit maximization requires that firms produce until marginal revenue equals marginal cost.[294] Since market prices are such that consumers are willing to pay for the product and producers are willing to supply the product, information on CRT costs, and in particular marginal costs, can be combined with information on demand to solve for the price that satisfies both sides of the market.

Although marginal cost plays an important role in analyzing firm pricing behavior, it is not directly observed and differs from costs reported in accounting data; accounting data must be adjusted to approximate economic cost.[295] One of the prominent ways accounting costs differ from economic costs is in their treatment of capital: to an economist, the cost to a firm of using its productive capital to produce output is the value of the opportunity to sell the capacity foregone by retention of the capacity by the firm. In an industry characterized by declining demand and capacity in excess of current and expected future demand, productive capital will not fetch a good price if sold,[296] so the cost of retaining and using productive capacity is low. Since the cost of using capacity is negligible, economic marginal cost is reasonably

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- Industry and firm-specific demand elasticities are estimated for the personal computer (PC) market using data on prices, technical attributes (e.g., hard disk capacity, processor speed), brand name, and shipment quantities. Stavins, Joanna, 1997, Estimating Demand Elasticities in a Differentiated Product Industry: The Personal Computer Market, Journal of Economics and Business, Vol. 49(4), 347-367.
- The Almost Ideal Demand System (AIDS) "is perhaps the most commonly used differentiated product demand system" and the "relevant parameters of an AIDS specification are also quite easy to estimate and the estimation process requires data that are normally available to the analyst, namely prices and expenditure shares [which are calculated from prices and quantities]". Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton, pp. 252-253.

[293] If this condition did not hold, then firms would be able to increase profits by altering production. For example, if the revenue a firm would earn from producing one more unit is greater than the cost of producing that unit, then the firm could increase its profits by producing one more unit. Similarly, if the cost of producing one more unit is greater than revenue earned from selling one more unit, then a firm can increase its profits by producing less since that would reduce its costs by more than the loss in revenue. In contrast, when the revenue earned on the last unit sold equals the cost of producing that unit, a firm cannot increase its profits by altering its level of production.

[294] Economists refer to incremental changes as marginal changes. That is, the revenue from producing one more unit is referred to as marginal revenue and the cost from producing one more unit is referred to as marginal cost.

[295] "The basis for measuring economic damages should be economic profit, but analysts are often limited by available data and must use accounting data to estimate damages. Fortunately, accounting data often can be adjusted to produce an estimate of true lost economic profits." American Bar Association, 2010, Proving Antitrust Damages: Legal and Economic Issues, Second Edition, ABA Publishing: Chicago, p. 99.

[296] "In dying industries, the value of capital is permanently less than replacement cost." Carlton, Dennis and Jeffery M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Addison-Wesley Longman, Inc., p. 249, footnote 4.

approximated by average variable costs calculated from accounting data. Section VI.C discusses evidence that the CRT industry was characterized by excess capacity and declining demand.

Accounting data (e.g., labor and materials costs) kept by firms in the regular course of business contain information useful for measuring average variable costs and from which estimates of marginal costs may be calculated. Section IX.1 describes available cost data that have thus far been obtained in the present case.

Alternatively, rather than directly estimating marginal costs, it is possible to use the economic relationship between price-cost margins and demand elasticity to recover marginal costs from data on prices and an estimate of the relevant demand elasticity. More formally, the Lerner index of market power establishes that a firm's price-cost margin is equal to the inverse of the magnitude of the elasticity of demand facing the firm.[297] This formula can be solved so that marginal cost is determined by price and the elasticity of demand.[298]

c) Competitive interactions between cartel members

In addition to demand and cost influences, the degree of competition from other firms will impact the final price at which the transaction occurs. Simply put, market outcomes are impacted when firms collude rather than compete. By collectively reducing output, a cartel is able to increase the market price above what any of its individual members would be able to achieve by reducing its own output.[299] As a result, by explicitly coordinating production and pricing

[297] For a derivation of the Lerner index of market power and its relationship to the elasticity of demand facing the firm, see, e.g.,

- Landes, William M., and Richard A. Posner, March 1981, Market Power in Antitrust Cases, Harvard Law Review, Vol. 9(5), pp. 984-985.
- Carlton, Dennis W., and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Person Addison Wesley, p. 92.

[298] See, e.g.,

- "Alternatively, if demand elasticities are estimated and the oligopoly solution concept is known, one can back out estimates of marginal costs using the Lerner relationships." Baker, Jonathan B., and Daniel L. Rubinfeld, 1999, Empirical Methods in Antitrust Litigation: Review and Critique, American Law and Economics Review, Vol. 1, No. 1, 386-435, p. 415, footnote 65.
- "With the estimated parameters of the demand function in hand, an assumption about firm conduct is sufficient to allow marginal costs to be recovered." Peters, Craig, October 2006, Evaluating the Performance of Merger Simulation: Evidence from the U.S. Airline Industry, Journal of Law and Economics, Vol. 49(2), 627-649, p. 634.
- "One option is to estimate marginal cost curves directly from industry cost information if this is possible. However, sometimes, given the pricing equations, the market prices and demand parameters, marginal costs can be inferred." Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press: Princeton, p. 402.

[299] See, e.g.,

- Carlton, Dennis W. and Jeffrey M. Perloff, 2005, Modern Industrial Organization, Fourth Edition, Person Addison Wesley, pp. 122-125.
- Baker, Jonathan B., and Timothy F. Bresnahan, June 1985, The Gains from Merger or Collusion in Product-Differentiated Industries, Journal of Industrial Economics, Vol. 33, Issue 4, A Symposium on Oligopoly, Competition and Welfare, 427-444, p. 428.

activities, each cartel member is able to gain from the increase in market price and earn higher profits than it could if it were to individually reduce output. The pricing model can be adjusted to reflect the but-for world by solving the profit-maximizing pricing decision at the level of the individual firm rather than as a solution to the profit-maximization problem solved by treating the cartel members as a single decision-making entity to reflect the fact that in the but-for world cartel members would not have been concerned with how their own behavior impacted the profits of rival firms.

A model of the CRT industry will be common across class members. The necessary inputs to the pricing model are demand and cost parameters, which can be estimated using evidence common to the class. That is, standard economic theory can be combined with common evidence to provide a formulaic measure of the but-for price.

4. Market power method: Measurement of overcharges based on a measure of market power

Instead of fully specifying a model of the industry to simulate the price that would have satisfied the demand and supply conditions of profit maximization to determine cartel members' but-for price, a fourth basis for quantifying the overcharge is to use the increase in market power that cartel members gained as a result of colluding as a basis for calculating the but-for price.[300] Since a firm's market power is driven by the elasticity of demand it faces,[301] an estimate of the firm's but-for elasticity of demand can be compared with the demand elasticity faced by the firm when it is part of the cartel to obtain a measure of the market power gained as a result of collusion. The reduction in market power – as measured by the increased elasticity of demand faced by the firm absent collusion – can then be directly translated to a reduction in Defendant's price-cost margin using the Lerner index – that the elasticity of demand is the inverse of the price-cost margin. The change in the price-cost margin can be used to calculate the but-for price.

The elasticity of demand facing the cartel can be measured in a number of ways. The elasticity of demand of a firm (or a group of firms coordinating their behavior) can be calculated using the market share of the firm (or collection of colluding firms), the market level elasticity of demand, and the elasticity of supply of other firms.[302] Alternatively, using the relationship established by the Lerner index, the elasticity of demand faced by the firm can be backed out of the price-cost margin for the cartel using actual price and cost data.

Similarly, the but-for elasticity of demand, which can be used in the Lerner index to get an estimate of the but-for price, can be measured in a number of ways. First, the but-for elasticity could be obtained from the same Lerner index formula used to calculate the cartel demand elasticity except that the cartel market shares would be disaggregated into individual market

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[300] I use the term "market power" as it is generally used in antitrust economics, that is, I use market power to refer to "the ability of a firm (or group of firms, acting jointly) to raise price above the competitive level without losing so many sales so rapidly that the price increase is unprofitable and must be rescinded". Landes, William M. and Richard A. Posner, March 1981, Market Power in Antitrust Cases, Harvard Law Review, Vol. 9(5), p. 937.

[301] See Section IX.3.a).

[302] The formula used to relate the firm-level (or group of firms) elasticity of demand to the market demand, market share of the firm, and the elasticity of supply "has long been part of the industrial organization literature". Landes, William M., and Richard A. Posner, March 1981, Market Power in Antitrust Cases, Harvard Law Review, Vol. 9(5), pp. 945-946.

shares. Alternatively, individual price-cost margins could be calculated and converted into individual firm-level elasticities of demand.

Exhibit 13 and Section IX.3.a) detail the relevant sales and cost data that have been produced thus far.

The model for calculating Defendants' reduction in market power from behaving independently is common across class members as is the formula for translating the reduced market power into a reduced but-for price. This is another common formulaic method using common evidence that can be used to measure the but-for CRT price for each class member.

5. Summary: There exist multiple methods to measure overcharges to direct purchasers that are susceptible to common proof

Defendants' collusive behavior prevented the realization (and hence observation) of independently set prices. I have described a number of approaches common to class members that form reasonable bases for what CRT prices are likely to have been absent cartelization of the industry. Specifically, the economic determinants method implements a reduced-form price equation to estimate the impact on prices due to cartel members' collusive behavior using market-level demand and cost data and a measure of the market structure; the benchmark comparison method uses the profit rates of firms in industries facing similar demand and cost conditions as CRT manufacturers but free from collusive behavior as the basis for measuring Defendants' but-for prices; the simulation approach implements economic models of each of the primary components that affect market prices – demand functions, marginal cost, and the competitive environment – and integrates these models with real-world data from the CRT industry to predict the profit-maximizing price based on cartel members engaging in independent rather than collusive behavior; and the market power approach bases the but-for price on the reduction in margin that cartel members are likely to have faced to due to the reduced market power that would have resulted from independent rather than collusive behavior. All of these methods are implemented using common, market-level data.

B. Measurement of the pass-through of the antitrust overcharge to indirect purchasers is susceptible to common proof

In Section VIII.C, I established that at least some portion of the overcharge to direct purchasers was passed through to class members, which is sufficient to establish impact. In order to calculate damages to class members, I need an estimate of the magnitude of the overcharge that was passed through to class members. That is, I need to measure the extent to which changes in the price of CRTs translate into changes in the price for CRT monitors and TVs. Below I describe evidence (data) and a method to estimate the pass-through rate; both the evidence and the method are common to all class members.

The data used for these studies represent the prices at which CRTs and CRT products are bought and sold throughout the distribution channel. Ideally one would be able to isolate the change in price resulting from the cartel's behavior. This would require that prices rise on the first day of the cartel and fall on the last day of the cartel, while all else is held constant. These conditions, however, are not observable for a variety of reasons. One can, however, observe how firms respond to other cost changes, which provide a reasonable and conservative proxy for how they would respond to the cartel overcharges. The data I use to measure pass-through contain a variety of ordinary cost changes faced by CRT resellers. I include all the usable data that has

been provided to me, which includes both large and small cost changes. Similarly, some of these cost changes are perceived by resellers as temporary, while others are permanent. Finally, some of the cost changes I examine are borne by all resellers, while others are firm-specific. In contrast, the cartel overcharge imposed on all CRT resellers was significant, impacted all resellers, and was perceived as a permanent cost increase. Economic theory shows that industry-wide, non-transitory cost changes will be passed through, while temporary cost changes that do not impact all resellers are not necessarily passed-through. The data I employ for my studies, therefore, provide a conservative estimate of the pass-through rate.

1. Econometric design

[redacted] Not all firms set price using this strategy; therefore, it is necessary to measure pass-through empirically. The purpose of the pass-through analysis is to determine how prices change when costs change, which can be represented mathematically as the calculation of the partial derivative $\partial p/\partial c$, where "p" represents the price of the product and "c" represents the cost of the product. Regression analysis is a way to measure or calculate the pass-through rate.[303] Economists routinely use regression analysis, inter alia, to calculate pass-through rates in a variety of industries.[304]

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[303] Regression analysis is an accepted and widely used tool in economics and the courts. See, e.g.,

- Rubinfeld, Daniel L., 2000, Reference Guide on Multiple Regression, in Federal Judicial Center, and National Research Council (Eds.), Reference Manual on Scientific Evidence, Third Edition, National Academies Press: Washington, D.C., 303-358. http://www.law.berkeley.edu/faculty/rubinfeldd/Profile/publications.html, accessed 15 May 2009.
- Davis, Peter, and Eliana Garces, 2010, Quantitative Techniques for Competition and Antitrust Analysis, Princeton University Press (Princeton, NJ: 2010) at pp. 368-375.

[304] See, e.g., the following, which represents but a small portion of the pass-through studies reported in peer-reviewed, scholarly journals:

- Bachmeier, L.J. and J.M. Griffin, 2003, New Evidence on Asymmetric Gasoline Price Responses, Review of Economics and Statistics, Vol. 85(3).
- Bacon, R.W., 1991, Rockets and Feathers: the Asymmetric Speed of Adjustment of UK Retail Gasoline Prices to Cost Changes, Energy Economics, Vol. 13.
- Beetendorf, L., S.A. Van Der Geest, and M. Varkevisser, 2003, Price Asymmetries in the Dutch Gasoline Market, Energy Economics, Vol. 25.
- Besley, Timothy, and Harvey Rosen, June 1999, Sales Taxes and Prices: An Empirical Analysis, National Tax Journal, Vol. 52, pp. 157-178.
- Brownlee, Oswald, and George Perry, 1967, The Effects of the 1965 Federal Excise Tax Reduction on Prices, National Tax Journal, Vol. 20(3), pp. 235-249.
- Due, John F., December 1954, The Effect of the 1954 Reduction in Federal Excise Taxes on the List Prices of Electrical Appliances, National Tax Journal, Vol. 39, pp. 539-40.
- Harris, Jeffrey E., 1987, The 1983 Increase in the Federal Cigarette Excise Tax, in Tax Policy and the Economy, Vol. 1, Lawrence H. Summers, ed., MIT Press: Cambridge, pp. 87-112.
- Kirchgassner, G., and K. Kubler, 1992, Symmetric or Asymmetric Price Adjustments, Energy Economics, Vol. 14.

In order to estimate the pass-through rate for the entire distribution channel or any portion of it,[305] I regress the price at the lowest point in the channel on the cost at the highest point in the channel.[306] The coefficient on the upstream cost variable gives the pass-through rate. In this analysis, price and cost are the required variables to estimate the pass-through rate. However, there may be differences across some of the products (e.g., screen size) that also impact the price level. Therefore, whenever the data permit, I include variables to control for these different product characteristics as well. Appendix B provides a detailed description of the econometric methods used in the pass-through studies summarized below.

2. Summary of econometric estimates of pass-through

I conduct 40 empirical pass-through studies and, whenever possible, I calculate pass-through rates by application; that is, I calculate separate rates for tubes, monitors, and TVs. I use data produced by Defendants as well as third parties; some of these data are transaction-level data, meaning they represent the actual amount paid by the purchaser, while some of these data are price lists or price guidelines from which actual transaction prices are derived.

It is neither feasible nor necessary to measure pass-through for each individual firm in the distribution channel for several reasons. There are many firms that participate in the production and distribution of CRT products, and not all of them maintain the data necessary to measure pass-through. Many of these resellers are located outside the U.S. and I understand are not obligated to respond to Plaintiffs' subpoenas requesting data. Some resellers no longer exist, nor do data on their past sales. Even if these data did exist and were readily available, it would not be necessary or practical to measure pass-through for each and every firm; instead, one can accurately measure pass-through by obtaining a representative sample of all the firms in the distribution channel, which is the approach that I use. Plaintiffs' counsel has, with my input, subpoenaed a range of different types of firms (e.g., "big box" stores, online retailers) operating at all levels of the distribution channel (e.g., product manufacturers, retailers), selling all types of at-issue CRT products. Using these third-party data produced in response to Plaintiffs' subpoenas, as well as other data produced by Defendants, I have completed a considerable number of pass-through studies using data that represent the pricing decisions made by the various types of CRT resellers operating throughout the distribution channel. Discovery is ongoing and I reserve the right to supplement my analysis as new data becomes available.

- Poterba, Jim, 1996, Retail Price Reactions to Changes in State and Local Sales Taxes, National Tax Journal, Vol. 49(2), pp. 165-176.
- Sidhu, Nancy D., The Effects of Changes in Sales Tax Rates on Retail Prices, in Proceedings of the Sixty-Fourth Annual Conference on Taxation, National Tax Association-Tax Institute of America: Columbus, pp. 720-733.
- Woodard, F.O., and Harvey Siegelman, 1967, Effects of the 1965 Excise Tax Reduction upon the Prices of Automotive Replacement Parts, National Tax Journal, Vol. 20(3), pp. 250-258.

[305] This approach may be applied to data spanning the entire distribution channel using the cost of CRTs at the top of the channel matched with CRT finished goods retail prices at the bottom of the channel. Alternately, this same approach can be applied to any individual level in the distribution channel. In the former approach, the pass-through rate for the entire channel is calculated directly; in the latter approach, the pass-through rate over the entire distribution channel is the product of the pass-through rates for each portion of the distribution channel.

[306] As stated above, regression analysis is a widely accepted tool of economics that has also been widely accepted by the courts. See footnote 304.

[redacted]

[redacted]

In addition to the Wal-Mart studies discussed above, I have conducted additional 37 pass-through studies, which fall into two general categories: those that measure pass-through over the entire distribution channel and those that measure pass-through for an individual level of distribution.

As described in Section VIII.C, there are two approaches for estimating pass-through over the entire channel: by looking at the relationship between costs at the top of the distribution chain and prices at the bottom of the distribution chain and by estimating the pass-through rate at each level of distribution chain and then multiplying them. I refer to the empirical implementation of these concepts the top-and-bottom approach and the top-to-bottom approach, respectively. Both of these approaches are implemented by using the same data, i.e., CRT prices, for the top of the channel; however, different data are used for the bottom of the channel. The top-and-bottom approach uses retail or "street" prices for products being sold to end-users as the downstream price.[313,314] The top-to-bottom approach incorporates data from multiple levels of the channel including as many intermediate resellers as necessary to trace specific products through the entire distribution chain from the CRT manufacturer to the end customer.[315]

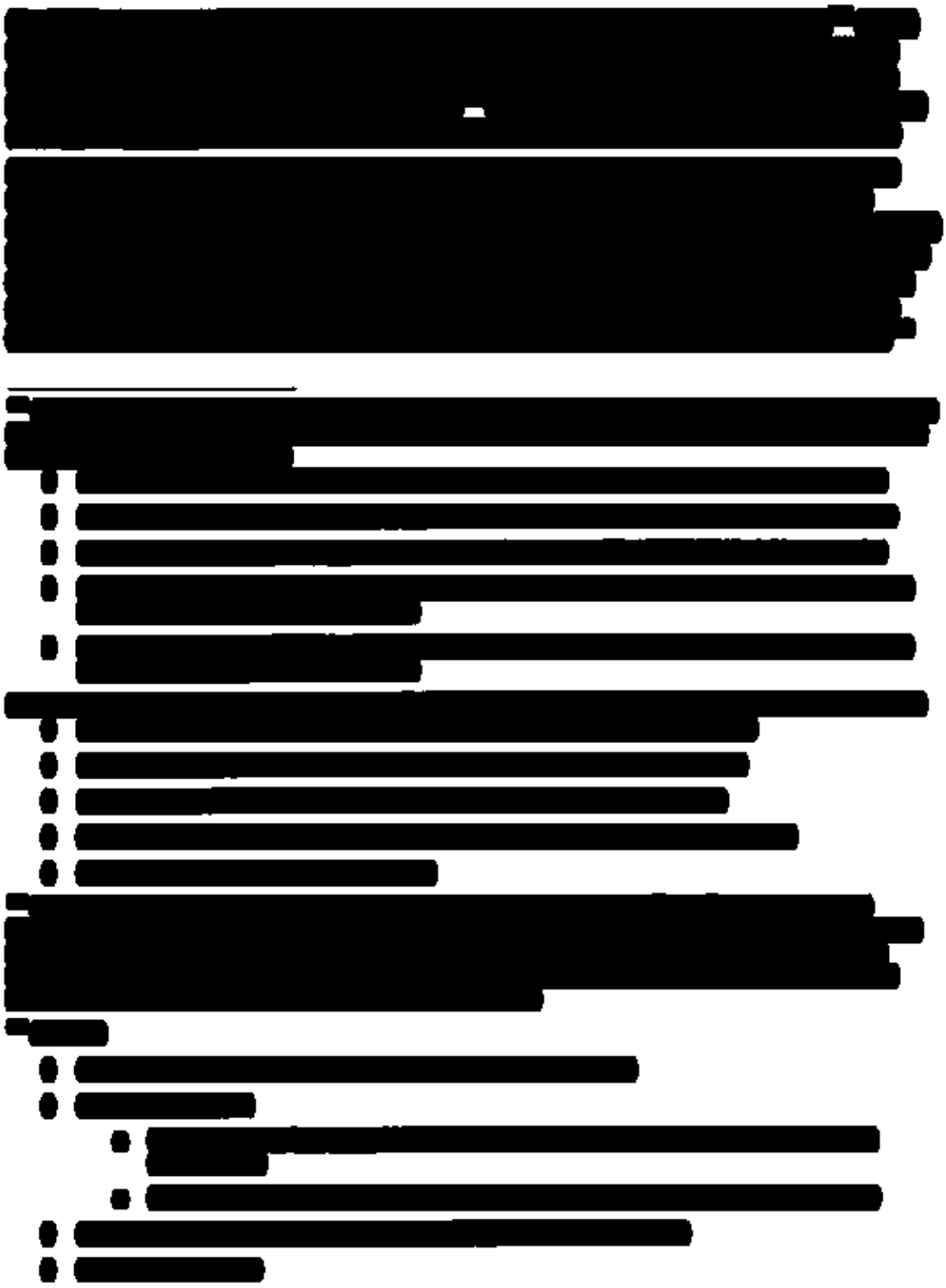
I have conducted one top-and-bottom study and one top-to-bottom study. [redacted]

[313] The top-and-bottom approach does not use data from any intermediate resellers. Rather, the pass-through rates of intermediate resellers are subsumed within the analysis. This approach estimates a single pass-through coefficient for the entire distribution channel.

[314] Estimating the pass-through rate for an entire distribution chain by looking at the prices at the top and bottom of the distribution chain is common in the peer-reviewed, published, scholarly economic literature. See, e.g.,

- Aaronson, Daniel, February 2001, Price Pass-through and the Minimum Wage, The Review of Economics and Statistics, Vol. 83(1), pp. 158-169.
- Gron, Anne, and Deborah Swenson, May 2000, Cost Pass-Through in the U.S. Automobile Market, The Review of Economics and Statistics, Vol. 82(2), pp. 316-324.
- Kadiyali, Vrinda, 1997, Exchange Rate Pass-through for Strategic Pricing and Advertising: An Empirical Analysis of the U.S. Photographic Film Industry, Journal of International Economics, Vol. 43, pp. 437-461.
- Karp, Larry S., and Jeffrey M. Perloff, March 1989, Estimating Market Structure and Tax Incidence: The Japanese Television Market, The Journal of Industrial Economics, Vol. 37(3), pp. 225- 239.
- Leibtag, Ephraim, Nakamura, Alice, et al., March 2007, Cost Pass-Through in the U.S. Coffee Industry, United States Department of Agriculture Economic Research Service Economic Research Report Number 38.
- Nakamura, Emi, and Dawit Zerom, August 2009, Accounting for Incomplete Pass-Through, NBER Working Paper 15255, http://www.nber.org/papers/w15255.
- Radchenko, Stanislav, 2005, Lags in the Response of Gasoline Prices to Changes in Crude Oil Prices: The Role of Short-Term and Long-Term Shocks, Energy Economics, Vol. 27, 573-602.
- Sumner, Daniel A., October 1981, Measurement of Monopoly Behavior: An Application to the Cigarette Industry, The Journal of Political Economy, Vol. 89(5), 1010-1019.

[315] This approach requires being able to identify the customers in each dataset as well as trace the specific products across datasets, preferably by manufacturer part number and date. This approach estimates multiple pass-through coefficients—one for each level of the distribution channel represented in the data. The product of each of these pass-through coefficients gives the pass-through rate for the entire channel.



[redacted]

C. Class-wide damages can be calculated using a common formulaic method

A measure of class-wide damages can be obtained by determining the portion of Defendants' revenues from at-issue products that is attributable to the cartel overcharge in passed down the distribution chain to class members. The calculation to do so is a straight-forward application of the overcharge to direct purchasers and pass-through rates to class members. Specifically, class-wide damages can be calculated as the product of Defendants' revenues from at-issue products, the overcharge rate, and the pass-through rate.

To calculate total revenues, I first would calculate the quantity of tubes manufactured by Defendants and conspirators that the class members purchased, by year and product type. I then could calculate weighted average prices of CPTs and CDTs by year. Defendants' revenue by year and product type would be the product of weighted average price and quantity.

1. Shipments of CRT tubes

To determine the revenue Defendants received from class members' indirect purchases of at-issue products during the class period, March 1, 1995 through November 25 2007,[320] I would begin by calculating the shipments of CRT tubes that are used in the products at-issue – monitors and TVs.

[redacted]

Calculating the Defendants' sales to class members during the class period begins with determining total worldwide shipments of CDTs and CPTs.[323] I would next calculate the

[320] Complaint, ¶1.

[redacted]

defendants' share of total shipments. To calculate the share of worldwide CRT production ultimately consumed in North America, I use data on consumption of CRT monitors and TVs because CRT are consumed in North America in CRT products. The DisplaySearch Custom Data Project breaks shipments of monitors and TVs down by region, including North America, for 1999 - 2010 and 2004-2010, respectively.[324] This would give North America's consumption share of Defendants' worldwide CPT and CDT production. The total North America consumption could be calculated by multiplying the North America share by the Defendants' worldwide shipment for that year.

I would exclude those CRT tubes sold into Canada and Mexico by assuming that North American consumers purchase CRT products in proportion to each country's gross domestic product (GDP); thus, I would multiply the North American units by the U.S. share of the combined U.S., Mexican, and Canadian GDP to obtain the total U.S. shipments.

2. Eliminate government purchases

Government entities are not a part of the class; therefore, I would exclude those U.S. shipments that are derived from government purchases.[325] To calculate the share of shipments resulting from government purchases, I would use data on the breakdown of computer sales between government entities and private consumers, which are provided by the U.S. Bureau of Economic Analysis (BEA, part of the Department of Commerce).[326] Using the BEA data results in a conservative estimate of class shipments for televisions because the government share of television purchases is likely to be smaller than the government shares of monitor purchases.

3. Class member shipments

Only residents living in certain states are part of the Indirect Purchaser State Classes.[327] I assume that CRT end-product sales are distributed across states according to population. To calculate the number of CPT and CDT purchased by class members, I would multiply each year's total, non-

[redacted]

[325] Complaint, ¶232.

[324] Bureau of Economic Analysis, 20 August 2012, Final Sales of Domestic Computers, http://www.bea.gov/national/xls/comp-gdp.XLS, accessed 20 September 2012.

[327] Complaint, ¶234.

government, U.S. shipments by the population share of the states that are included in the class.[328] That is, I would allocate the total non-governmental U.S. shipments to class states based on population shares.

4. Average weighted price by period and application

Using data produced by Defendants,[329] I could generate quarterly CPT and CDT prices.[330,331] The total U.S. shipments for each year and application would be multiplied by the average price resulting in the total U.S. revenues for that year. For example, if only 14" and 15" CDTs were produced, to calculate weighted average price:

$$(percent_1 * price_1) + (percent_2 * price_2) = weighted\ average\ price$$

where $percent_1$ is the percent of U.S. tube sales that were 14" CDTs and $percent_2$ is of U.S. tube sales that were 15" CDTs. Then $price_1$ is the average price of 14" CDTs and $price_2$ is the average price of 15"CDT in 1999. The result is the weighted average price for 1999.

5. Defendant revenue from sales to class members

To generate total Defendant and Co-conspirator revenues from (indirect) tube purchases by class members, I would multiply the average price by the class member units purchased for each year and sum across all years to get total revenues from class members' purchases.

6. Arithmetic

Damages to class members, for each product at-issue and for each year, are then the product of revenues from class members for each product at-issue and for each year, multiplied by the appropriate overcharge rate, and multiplied by the appropriate pass-through rate.

X. Summary of conclusions

After analyzing the relevant facts, I conclude that, if Defendants engaged in the alleged price fixing conduct, the CRT cartel was effective at increasing prices in a common manner to direct purchasers. Pass-through of the overcharges to direct purchasers occurred on a common basis, leading to a common impact on class members. That is, class members paid a higher price for CRT monitors and TVs as a result of the cartel's conduct.

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[328] Arizona, California, District of Columbia, Florida, Hawaii, Iowa, Kansas, Maine, Michigan, Minnesota, Mississippi, Nebraska, Nevada, New Mexico, New York, North Carolina, North Dakota, South Dakota, Tennessee, Vermont, West Virginia, and Wisconsin. Dakota, Tennessee, Vermont, West Virginia, and Wisconsin. 11 December 2010, Indirect Purchaser Plaintiffs' Third Consolidated Amended Complaint, In re: Cathode Ray Tube (CRT) Antitrust Litigation (United States District Court Northern District of California San Francisco Division) (Hereinafter "Third Consolidated Amended Complaint"), ¶233.

[329] See Exhibit 13.

[330] To calculate weighted average price for each year, I would multiply the average price for a given size by the number of units sold for that size divided by the total units sold that year. Summing the results across all sizes provides the weighted average selling price for that year and application.

[redacted]

I describe methods that can be used to calculate the overcharge to direct purchasers on a common, formulaic basis, and I describe a common method to calculate the pass-through rate of CRT price increases on CRT product prices as well as present illustrative pass-through studies. Given the feasibility of calculating the overcharge and estimating pass-though, I conclude that damages to class members can be calculated using common evidence on a common, formulaic basis.

The analyses performed are applicable to all class members, no matter in which state the class member resides, no matter in what time period the CRT product was purchased, no matter from whom the product was purchased, and no matter whether the purchase was a TV or monitor. The analyses are based on common evidence.

XI. Appendix A: Brief description of defendants

A. Chunghwa companies

[redacted]

B. Daewoo companies

[redacted] Orion became a Daewoo company in 1983[328] and was one of a handful of companies retained by Daewoo[329] after the conglomerate

[redacted]

[328] Deflection Unit, 04 May 2004, Orion Electric Gets Interest, The Daily Deal, http://www.accessmylibrary.com/article-1G1-116222742/orion-electric-gets-interest.html, accessed 21 August 2012, p. 1.

[329] The Japanese Research Institute, United, June 1999, RIM, June 1999, No. 44, http://www.jri.co.jp/MediaLibrary/file/english/periodical/rim/2012/44.pdf, accessed 17 August 2012, p. 9.

was forced to restructure in 1999.[340] Orion was spun off from Daewoo in the early 2000's,[341] entered court receivership in 2003,[342] and was acquired by a U.S. investment fund in 2005.[343]

C. Hitachi companies

Hitachi is a Japanese conglomerate which produced CRTs at facilities in Japan, China, Malaysia, Singapore and the U.S.[344] [redacted] In 2002, the company's display group was spun off to a new company named Hitachi Displays. By 2007, Hitachi was no longer producing CRTs.[346]

D. IRICO companies

[redacted] is a Chinese state-owned enterprise which produces CPTs, CRT components, and other display products. IRICO was founded in 1989 as a parent company for CRT operations[348] which had begun as early as 1977 at a facility in Shaanxi, China.[349] IRICO produces CPTs and CRT components through a network of Chinese subsidiaries, including IRICO Display Devices. IRICO owns several of its subsidiaries indirectly through an intermediate company named IRICO Group Electronics.[350] IRICO's major customers included TCL, Skyworth, Konka, Changhong, and Hisense – all Chinese television producers.[351]

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[340] Nam In-soo, 18 August 1999, Daewoo Foreign Bankers Form Debt Talks Panel, PHLP-CRT-081989 - PHLP-CRT-081992 at 1989.

[341] Deflection Unit, 04 May 2004, Orion Electric Gets Interest, The Daily Deal, http://www.accessmylibrary.com/article-1G1-116222742/orion-electric-gets-interest.html, accessed 21 August 2012, p. 1.

[342] Deflection Unit, 04 May 2004, Orion Electric Gets Interest, The Daily Deal, http://www.accessmylibrary.com/article-1G1-116222742/orion-electric-gets-interest.html, accessed 21 August 2012, p. 1.

[343] 22 February 2005, Orion Electric Sold to U.S. Fund Matlin Patterson, Asia Africa Intelligence Wire, http://www.accessmylibrary.com/coms2/summary_0286-18874308_ITM, accessed 17 August 2012, p. 1.

[344] Exhibit 3 [redacted]

[346] Exhibit 3 [redacted]

[348] IRICO Group Corporation, 2009, Corporate Events, http://www.ch.com.cn/english/txt.jsp?urltype=tree.TreeTempUrl&wbtreeid=1466, accessed 22 August 2012, p. 1.

[349] 2009, About IRICO, http://www.ch.com.cn/english/txt.jsp?urltype=tree.TreeTempUrl&wbtreeid=1459, accessed 21 August 2012, p. 3.

[350] IRICO Group Electronics, 2004, IRICO Group Electronics Company Limited, http://quote.morningstar.com/stock-filing/Annual-Report/2004/12/31/t.aspx?t=XHKG:00438&ft=&d=b0c4e2a0ff0cfe9f, accessed 07 August 2012, p. 82.

[351] IRICO Group Electronics, 2004, IRICO Group Electronics Company Limited, http://quote.morningstar.com/stock-filing/Annual-Report/2004/12/31/t.aspx?t=XHKG:00438&ft=&d=b0c4e2a0ff0cfe9f, accessed 07 August 2012, p. 3.

E. LP Displays companies

LP Displays was founded in 2001 as a 50/50 joint venture between LG Electronics and Philips.[352] Both companies transferred their CRT activities to the new company at this time. LP Displays produced CRTs and components through its subsidiaries and joint ventures in Europe (the Netherlands, France, Germany, the UK, the Czech Republic, Slovakia, and Poland), Asia (China, South Korea, and Indonesia), and the Americas (Brazil, Mexico, and the U.S.).[353] In 2006, two major LP Displays holding companies declared bankruptcy,[354] and over the next few years several other LP Displays companies underwent bankruptcy, liquidation, or sale.[355] The company's name was changed from LG.Philips Displays to LP Displays in 2007.[356]

LG Electronics ("LGE") is a Korean manufacturer of consumer electronics. Prior to the formation of LP Displays, LGE manufactured CRTs at facilities in China, Indonesia, Mexico, South Korea, the UK, and the U.S. See Exhibit 3. LGE purchased a majority share of Zenith, an American producer of CRTs and televisions, in 1995.[357]

Philips, a Dutch company, also produced consumer electronics. Prior to 2001, a Philips subsidiary named Philips Display Components managed the manufacture of CRTs and finished products for Philips.[358] In December 2005, Philips wrote off the remaining value of its investment in LP Displays[359] and announced that it would not inject further capital into the joint

[352] A.A.M. Deterink, 01 March 2006, Trustee's First Report in the bankruptcy of LG.Philips Displays Holding B.V. and LG.Philips Displays Netherlands B.V., http://deterinklive.com/nl/publicaties/faillissementsverslagen/1/, accessed 12 July 2012, p. 6.

[353] A.A.M. Deterink, 01 March 2006, Trustee's First Report in the bankruptcy of LG.Philips Displays Holding B.V. and LG.Philips Displays Netherlands B.V., http://deterinklive.com/nl/publicaties/faillissementsverslagen/1/, accessed 12 July 2012, p. 7.

[354] 02 February 2006, LG.Philips Displays files for bankruptcy protection, EE Times Asia, http://www.eetasia.com/ART_8800405639_480700_NT_5ae0362e.HTM#, accessed 09 July 2012, p. 1.

[355] A.A.M. Deterink, 20 November 2008, Trustee's Sixth Report in the bankruptcy of LG.Philips Displays Holding B.V. and LG.Philips Displays Netherlands B.V. and LG.Philips Displays Investment B.V., http://deterinklive.com/nl/publicaties/faillissementsverslagen/1/, accessed 12 July 2012, pp. 7-17.

[356] Undated, Company Overview of LP Displays, Business Week, http://investing.businessweek.com/research/stocks/private/snapshot.ASP?privcapId=1492342, accessed 09 July 2012, p. 1.

[357] 13 March 1996, Zenith Breaks Ground for Expansion of Melrose Park Color Picture Tube Plant, PR Newswire, http://www.thefreelibrary.com/ZENITH+BREAKS+GROUND+FOR+EXPANSION+OF+MELROSE+PARK+COLOR+PICTURE+TUBE...-a018086464, accessed 16 July 2012, p. 1.

[358] 27 November 2000, Philips and LG Join Forces in Display Components Activities, Business Wire, http://findarticles.com/p/articles/mi_m0EIN/is_2000_Nov_27/ai_67364504, accessed 19 February 2009, p. 1.

[359] Philips, 21 December 2005, Philips writes off its book value for LG.Philips Displays, http://www.newscenter.philips.com/main/standard/about/news/press/archive/2005/article-15235.wpd, accessed 24 August 2012, pp. 1.

venture.[360] Prior to the formation of LP Displays, Philips produced CRTs in Austria, Brazil, China, the Czech Republic, France, Spain, Taiwan, the U.K., and the U.S.[361]

F. Mitsubishi Electric companies

Mitsubishi Electric ("Mitsubishi"), a member company of the Mitsubishi Group, is a major Japanese producer of electric and electronic equipment. The company was founded in 1921 and began producing color TVs in 1960.[362] Mitsubishi produced CRTs at plants in Mexico, Canada, and Japan.[363]

G. MT Picture Display companies

MT Picture Display ("MTPD") was formed in April 2003 when Panasonic and Toshiba merged their non-Japanese CRT activities.[364] In 2002, the companies had begun cooperating on sourcing for their CRT businesses through a joint venture named Matsushita Toshiba Displays Procurement Co.[365] At the time that MTPD was formed, Panasonic and Toshiba possessed ownership shares of 64.5% and 35.5%, respectively.[366] In April 2007, Panasonic acquired Toshiba's share and changed the company's name from Matsushita Toshiba Picture Display to MT Picture Display.[367]

Prior to the formation of MTPD, Panasonic produced CRTs at facilities in China, Japan, Germany, Malaysia, and the U.S.[368] While the majority of Panasonic's CRT activities were transferred to MTPD when the joint venture was established in 2001, Panasonic retained a factory in Takatsuki, Japan.[369] Panasonic was known as known as Matsushita Electric Industrial until 2008

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[360] Philips, 21 December 2005, Philips writes off its book value for LG.Philips Displays, http://www.newscenter.philips.com/main/standard/about/news/press/archive/2005/article-15235.wpd, accessed 24 August 2012, pp. 1.

[361] Exhibit 3

[362] Mitsubishi Electric Corporation, 2012, About us - 1920s - 1970s: Mitsubishi Electric, http://www.MitsubishiElectric.com/company/about/history/1920s-70s/index.html, accessed 19 September 2012, pp.1-3.

[363] Exhibit 3

[364] Toshiba, 26 September 2002, Matsushita and Toshiba to Consolidate CRT Business, http://www.Toshiba.com/taec/news/press_releases/2002/to-238.jsp, accessed 23 August 2012, p. 1.

[365] Toshiba, 26 September 2002, Matsushita and Toshiba to Consolidate CRT Business, http://www.Toshiba.com/taec/news/press_releases/2002/to-238.jsp, accessed 23 August 2012, p. 1.

[366] Panasonic, 29 January 2003, Matsushita Announces Specific Plans Regarding New CRT Joint Venture with Toshiba, http://panasonic.net/ir/relevant/en030129-6/en030129-6.html, accessed 10 July 2012, p. 4.

[367] Panasonic, 30 November 2005, Matsushita to Close CRT operations in North America and Europe, http://panasonic.net/ir/relevant/2005/en051130-3.pdf, accessed 10 July 2012.

[368] Exhibit 3

[369] Panasonic, 29 January 2003, Matsushita Announces Specific Plans Regarding New CRT Joint Venture with Toshiba, http://panasonic.net/ir/relevant/en030129-6/en030129-6.html, accessed 10 July 2012, p. 1.

Prior to the formation of MTPD, Toshiba produced CRTs at facilities in Indonesia, Japan Thailand, and the U.S. Like Panasonic, Toshiba retained its Japanese production facilities after the formation of MTPD.

H. Samsung companies

[redacted]

I. Samtel companies[372]

The Samtel Group ("Samtel"), founded in 1973, is an Indian manufacturer of displays and electronic components. The company began producing black and white CRTs in 1973 through its subsidiary firm, Teletube Electronics. In 1987, Samtel Color, a Samtel subsidiary entered in 1986, entered into a technical collaboration agreement with Mitsubishi Electric and began producing color CPTs. Samtel's CRT production took place primarily through two subsidiaries: Samtel Color and Samtel India. Samtel Color produced color CPTs while Samtel India produced black and white CRTs.

J. Thai CRT

[redacted] The company produced CRTs and components through three subsidiaries, all of which operated in Thailand. Thai CRT passed a resolution of dissolution and ceased its business activities in June 2007.[374]

K. Thomson companies

[redacted]

[372] See, e.g.,

- Samtel, 2012, About Us: Samtel Group, http://www.samtelgroup.com/?page=about_us, accessed 28 August 2012.
- Samtel, 2012, Samtel Color Ltd.: Corporate Profile, http://www.samtelcolor.com/?page=about_us, accessed 28 August 2012.
- Samtel, 2012, Samtel: Historical Milestones, http://www.samtelgroup.com/?page=history, accessed 28 August 2012.
- Samtel, 2000, Samtel India Limited [PT Division], http://www.siplweb.com/samtel/group/sil-ptdiv-bhiwadi.ASP, accessed 28 August 2012.

[redacted]

[374] Japan Fair Trade Commission, 27 October 2009, Cease-and-Desist Order and Surcharge Payment Orders against Manufacturers of Cathode Ray Tubes for Televisions, http://www.jftc.go.jp/en/pressreleases/uploads/2009-Oct-7.pdf, accessed 11 July 2012, p. 5.

Thomson Multimedia ("Thomson") is a subsidiary of Thomson S.A., a French state-owned corporation.[375] Thomson produced a variety of consumer electronics and multimedia products, including CRTs and CTVs. [redacted] Thomson had previously manufactured CRTs in the United States as well.

L. Videocon companies

[redacted]

XII. Appendix B: Econometric methods for pass-through

A. The basic regression

The pass-through rate can be estimated by regressing the price of the CRT product on the cost of the CRT.[386] Mathematically, the regression equation for these studies can be represented by

[redacted]

[375] Thomson, 30 May 2003, Thomson 20-F 2002, http://www.technicolor.com/uploads/thomson20f2002.pdf, accessed 28 August 2012, p. 24.

[redacted]

[385] Dow Jones Newswires, 28 June 2005, Thomson Agrees to Sell Cathode-Ray Tube Business, http://online.wsj.com/article/0,,SB111995081554171422,00.html, accessed 21 August 2012, p. 1.

[redacted]

[386] The approach of regressing price on cost to estimate the pass-through rate is commonly used in the academic literature. See, e.g.,

- Doyle, Maura P., July 1997, The Effects of Interest Rates and Taxes on New Car Prices, Board of Governors of the Federal Reserve System Finance and Economics Discussion Series 1997-38.
- Stennek, Johan, and Frank Verboven, 03 May 2001, Merger Control and Enterprise Competitiveness - Empirical Analysis and Policy Recommendations, Research Institute of Industrial Economics Working Paper No. 556.

$$\text{price} = \alpha + \beta\ \text{cost} + \varepsilon \quad \text{or} \quad p = \alpha + \beta c + \varepsilon,$$

where p is the price of the CRT product, c is the cost of the CRT, and ε represents the error term. In this equation, the pass-through rate, which is equal to the derivative $\partial p/\partial c$, is equal to β; that is, the coefficient on the cost variable gives the pass-through rate.

Similar regressions can be used to estimate the pass-through rate for the entire distribution channel or a portion of it. In either case, the price paid by the downstream purchaser (which could be a product manufacturer, a distributor, a reseller, or and end customer) for whatever item the downstream purchaser buys (it could be a CRT or it could be a product containing a CRT) is regressed on the upstream cost of either the CRT or the CRT product. In each case, the coefficient on the upstream cost variable gives the pass-through rate.

In the regressions as applied to the CRT industry, the cost variable that is included generally captures the majority of the cost of the item that is being sold. For example, when a firm is a product distributor or a retailer, the cost included in the regression is the entire cost of the CRT product, be it a monitor or TV. When a firm is a product manufacturer, the cost included is the cost of the CRT,[387] [redacted]

- See also footnote 314.

[387] The cost data provided by some product manufactures included the cost for the complete finished CRT product. This is likely due to the fact that some product manufactures outsource the manufacturing of some products.

[388] See, e.g.,

- CRT TVs:
  - The CRT accounts for approximately 50% of the total value of the components in a finished television. U.S. International Trade Commission, May 1995, Industry Trade Summary: Television Picture Tubes and Other Cathode-Ray Tubes, USITC Publication 2877, http://www.usitc.gov/publications/docs/pubs/industry_trade_summaries/PUB2877/PUB2877.PDF, accessed 15 March 2012, p.1.
  - [redacted]
- CRT Monitors:
  - [redacted]

B. Other determinants of price

Price and cost are the necessary variables for the calculation of the pass-through rate, but it is possible that product characteristics (e.g., screen size) may also have an impact on the price level. I include variables to control for different product characteristics to the extent possible given the data. The variety and detail of each dataset determine which characteristics can be reliably controlled for in each study. I run separate regressions for each application and, whenever possible, control for the following attributes: screen size, CRT manufacturer, resolution, high definition, and flat screen.[389] These product attributes were selected based on industry documents, which commonly classified products using these criteria.[390]

Including additional regressors in the analyses does not affect the interpretation of the coefficient on the cost variable as the pass-through rate, nor does it constitute the use of a different method in any respect; rather, the inclusion of these regressors is a variation on the same method of regressing downstream price on an upstream cost. The purpose of adding additional regressors is to account for the unique characteristics inherent in each dataset. As stated above, I attempt to control for the same product attributes whenever the data allow; however, not all datasets contain identical information on CRTs or CRT products.[391]

C. Variation in the data

In order to use regression analysis, variation must exist in the data. In other words, knowing only that a product sells for $100 and costs $50 is not informative of the pass-through rate, even if one observes that same combination of cost and price over time. These hypothetical data simply show that the price of the product is twice as large as the cost; there is no variation in cost or price from which I can draw meaningful conclusions regarding the impact of cost changes on price. In order to calculate the pass-through rate using regression analysis, I need observations that vary in price and in cost. There are two types of data variation that I can exploit: variations over time and variations over the cross-sectional unit.

If the data contain variations over time, I could observe the sale of a specific CRT at different points in time. If the cost of the CRT changes over time, then I can estimate how price changes when cost changes, which is the pass-through rate. With cross-sectional variation in the data, I would observe a specific CRT sold by different distributors or monitors containing different

- [redacted]
- [redacted]

[389] Not all datasets provided sufficient detail to control for these attributes. Some datasets provide additional information, allowing me to control for additional attributes including, but not limited to, the presence of the following: VCR or DVD TV combinations, wide screen, HD-ready, picture-in-picture, and re-manufactured/refurbished products.

[390] Although there are other product characteristics, application, size, resolution, and manufacturer are the characteristics commonly used to differentiate CRTs.

[391] For example, some of the datasets I employ are for CRT TVs and contain information on whether the product contained a built-in VCR or DVD player, whereas other datasets contain only sales for CRT monitors. In the former case, it makes sense to control for VCR/DVD combo; in the latter case, it does not.

CRTs sold by the same retailer, at a given point in time. If the cost of the CRT to the different distributors or the cost of the CRT in the monitors differs, then I could estimate the pass-through rate.

Time series data control for differences in the cross-sectional unit. That is, in looking at the same product sold at the same outlet over time, I do not have to contend with differences in products and/or outlets that may also impact price. However, when observing changes in prices and costs over time, not only is the cost changing, but other factors are changing too, such as the quality of the product relative to other available products. [redacted]

In contrast, cross-sectional data control for changes over time, such as the relative quality of the product, which may impact price. However, when observing multiple products or a product sold at multiple outlets at a single point in time, there may be differences across products and/or across outlets that may have an impact on price as well as on cost. [redacted]

As a third alternative, economists often use what is referred to as panel data, which contains variation across time and across a cross-sectional unit.

Typically an economist will use whatever data are available, specifying the regression to the specific characteristics of the data available. For example, if one uses cross-sectional units, one can include variables to control for differences in cross-sectional units, and if one uses time-series data, one can include variables to control for changes that take place over time.

I follow this strategy. That is, I use whatever data are available, whether they have cross-sectional variation, time-series variation, or both, and control for other effects as appropriate.

D. Is the entire overcharge passed through?

Because the distribution channel is highly competitive, I expect to find that pass-through is close to 100%, for the reasons described in Section VIII.C. Therefore I test whether, in each econometric study, the estimated pass-through rate is statistically significantly different than 100%.[394] For those studies that are statistically significantly different from 100%, I then test whether or not they are statistically significantly less than or greater than 100%.[395]

[redacted]

[394] To test whether or not the pass-through rate is statistically significantly different from 100%, I use a Wald test. Briefly, the Wald test is based on the difference between the estimated coefficient and the hypothesized value (so, in this case, the difference between the estimated coefficient and 1.00), relative to the standard error of the estimated coefficient. If the difference is (is not) sufficiently large, then one rejects (does not reject) the hypothesis that the true value of the coefficient is equal to the hypothesized value. Wooldridge, Jeffrey M., 2000, Introductory Econometrics, South-Western College Publishing, pp. 116-133. I use a 90% significance level in determining what

As I explained in Section VIII.C.1.c) when distribution firms operate in a perfectly competitive industry with constant costs, the theoretical pass-through rate is 100%. Because the distribution firms do not operate in a perfectly competitive industry, [redacted]

is sufficiently large to reject the null hypothesis; that is, I reject the null hypothesis when the p-value of the test statistic is less than 10%.

[99] In order for the hypothesis tests to be valid, the estimated standard errors must be unbiased, which means that the data must not be heteroskedastic. Heteroskedasticity refers to the situation where the variance on the error term is not constant. If heteroskedasticity is present but is ignored, the estimated standard errors are biased, and using them for tests of significance is invalid. Wooldridge, Jeffrey M., 2000, Introductory Econometrics, South-Western College Publishing, pp. 248-249.

To test for the presence of heteroskedasticity, I use the Breusch-Pagan test. Briefly, the Breusch-Pagan test is based on the idea that if the data are homoskedastic, the estimates using ordinary least squares will not differ much from the estimates using maximum likelihood. Breusch, T.S., and A.R. Pagan, September 1979, A Simple Test for Heteroskedasticity and Random Coefficient Variation, Econometrica, Vol. 47, pp. 1287-1294.

If I reject the null hypothesis of homoskedasticity (i.e., reject the null hypothesis of no heteroskedasticity), I calculate White's robust standard errors, which are unbiased and render the hypothesis testing valid. Hal White, 1980, A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, Econometrica, Vol. 48, pp. 817-38. If the data are subject to heteroskedasticity, the White standard error will be correct. If I assume the data are heteroskedastic and they are not, the White standard error is still asymptotically consistent.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief. This declaration was executed on the 1st day of October 2012, at Ann Arbor, Michigan.

JANET S. NETZ

Subscribed and sworn to before me this 1 day of October 2012.

Notary Public

My commission expires: ___

BRIAN PAUL ROSEWARNE
Notary Public, State of Michigan
County of Washtenaw
My Commission Expires May. 20, 2014
Acting in the County of

applEcon
Credible. Concise. Clear.

Dr. Janet S. Netz

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Education

Ph.D. economics, University of Michigan, 1992
M.A. economics, University of Michigan, 1990
B.A. economics, University of California at Berkeley, 1986, *cum laude*

Employment

Founder and Partner, applEcon, May 2001 to present
Visiting Associate Professor, University of Michigan, Fall 2001, Fall 2002, Fall 2003
Associate Professor, Purdue University, Fall 2001 to January 2003
Visiting Assistant Professor, University of Michigan, Winter 2001
Assistant Professor, Purdue University, Fall 1994 to Spring 2001
Assistant Professor, University of Delaware, Fall 1992 to Summer 1994

Courses Taught

Industrial Organization (undergraduate and doctoral)
Antitrust and Regulation (undergraduate)
Intermediate Microeconomics (undergraduate and master's)
Microeconomic Principles (undergraduate)
International Economics (undergraduate and master's)

Publications

"Are All Men's College Basketball Players Exploited?", with Erin Lane and Juan Nagel, *Journal of Sports Economics*, 2012 (forthcoming).

"Price Regulation: Theory and Performance", in *Regulation and Economics*, Roger J. Van den Bergh and Alessio M. Pacces, eds., Edward Elgar Publishing, 2011.

"Sports Trivia: A Review of The Economics of Intercollegiate Sports by Randy R. Grant, John Leadley, and Zenon Zygmont", *Journal of Economic Literature*, 47(2), June 2009, 485-489.

"One-Way Standards as an Anti-Competitive Strategy", with Jeffrey K. MacKie-Mason, in *Standards and Public Policy*, Shane Greenstein and Victor Stango, eds., Cambridge Press, 2007.

"International Integration and Growth: A Further Investigation on Developing Countries", with Claire Economidou and Vivian Lei, *International Advances in Economic Research*, 12(4), November 2006, 435-448.

"Maximum or Minimum Differentiation? An Empirical Investigation into the Location of Firms", with Beck A. Taylor, *Review of Economics and Statistics*, February 2002.

"International Integration and Growth: A Survey and Empirical Investigation", with Vivian Lei and Jon D. Haveman, *Review of Development Economics*, 5(2), June 2001.

"Price Regulation: A (Non-Technical) Overview", in *Encyclopedia of Law and Economics*, Boudewijn Bouckaert and Gerrit De Geest, eds, Edward Elgar and University of Ghent, 2000.

"Exercising Market Power in Proprietary Aftermarkets," with Severin Borenstein and Jeffrey K. MacKie-Mason, *Journal of Economic and Management Strategy*, 9(2), Summer 2000, 157-188.

"All in the Family: Family, Income, and Labor Force Attachment", with Jon D. Haveman, *Feminist Economics*, 5(3), November 1999, 85-106.

"Why Do All Flights Leave at 8am?: Competition and Departure-Time Differentiation in Airline Markets", with Severin Borenstein, *International Journal of Industrial Organization*, 17(5), July 1999, 611-640.

"An Empirical Test of the Effect of Basis Risk on Cash Market Positions", *Journal of Futures Markets*, 16(3), 289-312, May 1996.

"The Effect of Futures Markets and Corners on Storage and Spot Price Variability", *American Journal of Agricultural Economics*, 77(1), 182-193, February 1995.

"Antitrust Policy in Aftermarkets", with Severin Borenstein and Jeffrey K. MacKie-Mason, *Antitrust Law Journal*, 63(2), 455-482, Winter 1995.

"The Economics of Customer Lock-In and Market Power in Services", with Severin Borenstein and Jeffrey K. MacKie-Mason, in *The Service Productivity and Quality Challenge*, Patrick T. Harker, ed., Kluwer Academic, 1994.

Working Papers and Work in Progress

"Fantasy Football Points as a Measure of Performance", with Erin Lane and Juan Nagel

"Non-Profits and Price-Fixing: The Case of the Ivy League"

"The End of Collusion? Competition after Justice and the Ivy League and MIT Settle"

"Basis and Exchange Rate Risks and their Impact on Storage and Exports"

Research Grants and Awards

"Cooperation and Competition Among Nonprofits", Nonprofit Sector Research Fund, Aspen Institute, 2000.

"Product Customization and Product-Space Positioning", Dauch Center for the Management of Manufacturing Enterprises, Summer 2000.

"Outstanding Economics Professor of the Year", Economics Club, Purdue University, 1999.

"Trade Barriers, Trade Blocs, Growth, and Convergence", Purdue Research Foundation, 1998-1999.

"Effects of Informational Asymmetry on Competition in the Residential Long Distance Calling Market", Purdue Research Foundation, 1997-1998.

"Basis and Exchange Rate Risks and their Impact on Storage and Exports", Center for International Business and Economic Research, Summer 1997.

Global Initiative Faculty Grant (Course Development), "Industrial Organization in an International Marketplace", Purdue University, Summer 1997.

"Trade, Not Aid", Purdue Research Foundation, Summer 1996.

"Trade, Not Aid", Center for International Business and Economic Research, Summer 1996.

"The Effect of Price-Fixing by Institutions of Higher Education", Purdue Research Foundation, Summer 1995.

"Applied Microeconomics/International Workshop", Purdue University, Spring 1995.

"The Market Structure of Higher Education", University of Delaware, Summer 1993.

Research Associate, Center for the Study of Futures Markets, Columbia University, 1991.

Rackham Merit Fellowship, University of Michigan, 1987-1989.

Chancellor's Scholar, University of California at Berkeley, 1983-1986.

Referee

American Economic Review
Feminist Economics
International Journal of the Economics of Business
International Journal of Industrial Organization
Journal of Economic Education
Journal of Economic and Management Strategy
Journal of Family and Economic Issues
Journal of Futures Markets
Journal of Industrial Economics
Journal of Law and Economics
Journal of Law, Economics, and Organization
Management Science
Review of Economics and Statistics
Scandinavian Journal of Economics
Telecommunications Systems

Conference and Workshop Presentations

Panel participant, "Hot Topics Involving Experts in Antitrust Litigation", New York State Bar Association, Antitrust Law Section, Annual Meeting, New York, NY, January 2011.

Guest lecturer, Alternative Dispute Resolution Practicum, University of Michigan Law School, April 2008.

"The Economics of Indirect Purchaser Cases", State Bar of Arizona Annual Conference, Phoenix, AZ, June 2004.

"Manipulating Interface Standards as an Anti-Competitive Strategy", Standards and Public Policy Conference, Federal Reserve Bank of Chicago, Chicago, Il, May 2004.

"One-Way Standards as an Anti-Competitive Strategy", Telecommunications Policy Research Conference, Alexandria, VA, September 2002.

"Product Proliferation and Product Space Location", Econometric Society Meetings, New Orleans, January 2001.

"The End of Collusion? Competition after Justice and the Ivy League and MIT Settle", American Economics Association Meetings, New Orleans, January 2001.

"The End of Collusion? Competition after Justice and the Ivy League and MIT Settle", Indiana University-Purdue University Indianapolis, November 2000.

"Maximum or Minimum Differentiation? An Empirical Investigation into the Location of Firms", University of British Columbia, March 2000.

"Non-Profits and Price-Fixing: The Case of the Ivy League", University of Illinois, October 1999.

"The End of Collusion? Competition after Justice and the Ivy League and MIT Settle", Baylor University, September 1999.

"The End of Collusion? Competition after Justice and the Ivy League and MIT Settle", Western Economic Association Meetings, San Diego, July 1999.

"Non-Profits and Price-Fixing: The Case of the Ivy League", University of Chicago, April 1999.

"Non-Profits and Price-Fixing: The Case of the Ivy League", Indiana University, December 1998.

"International Integration and Growth: A Survey and Empirical Investigation", Dynamics, Economic Growth, and International Trade, III, Taiwan, August 1998.

Discussant ("Fiscal Policy and International Demand Spillovers"), Dynamics, Economic Growth, and International Trade, III, An International Conference, Taiwan, August 1998.

"International Integration and Growth", Workshop on Empirical Research in International Trade and Investment, Copenhagen, June 1998.

Discussant ("Factor Endowments and the Pattern of Affiliate Production by Multinational Enterprises," by Karolina Ekholm), Workshop on Empirical Research in International Trade and Investment, Copenhagen, June 1998.

"Non-Profits and Price-Fixing: The Case of the Ivy League", Department of Justice Antitrust Division, April 1998.

"Non-Profits and Price-Fixing: The Case of the Ivy League", American Economics Association Meetings, Chicago, January 1998.

Discussant ("Equilibrium under Satisficing," by Ralph W. Pfouts), International Atlantic Economics Society, ASSA Meetings, Chicago, January 1998.

Discussant ("Overseas Investments and Firm Exports," by Keith Head and John Ries), Fourth Annual Empirical Investigations in International Trade conference, Purdue University, November 1997.

"Maximum or Minimum Differentiation? An Empirical Investigation into the Location of Firms", International Atlantic Economic Association Conference, Philadelphia, October 1997.

Discussant ("Antidumping Enforcement in a Reciprocal Model of Dumping: Theory and Evidence," Taiji Furusawa and Thomas J. Prusa) and session chair, Third Annual Empirical Investigations in International Trade conference, Purdue University, November 1996.

"The Effect of Price-Fixing by Institutions of Higher Education", Indiana University-Purdue University Indianapolis, April 1996.

"Exercising Market Power in Proprietary Aftermarkets", with Severin Borenstein and Jeffrey K. MacKie-Mason, Indiana University - Purdue University - IUPUI First Tri-School Conference, March 1996.

"All in the Family: Family, Income, and Labor Force Attachment", with Jon D. Haveman, American Economic Association Meetings, San Francisco, January 1996.

"Family Matters: Unemployment, Wage Changes, and Mobility", with Jon D. Haveman, Southern Economics Association Meetings, New Orleans, November 1995.

Discussant and session chair, Second Annual Empirical Investigations in International Trade conference, Purdue University, November 1995.

"Competition and Anti-Competitive Behavior", ICLE (The State Bar of Michigan) Conference on Antitrust and Intellectual Property, July 1995.

"Price-Fixing, Tuition, and Financial Aid", Midwest Economics Association Meetings, Cincinnati, April 1995.

"Family Matters: Unemployment, Wage Changes, and Mobility," Midwest Economics Association Meetings, Cincinnati, April 1995.

Discussant and session chair, "Customer Discrimination, Entrepreneurial Decisions, and Investment", Midwest Economics Association Meetings, April 1995.

"An Empirical Test of the Effect of Basis Risk on Cash Market Positions", University of Illinois, Urbana-Champaign, February 1995.

Discussant and session chair, First Annual Empirical Investigations in International Trade conference, Purdue University, November 1994.

"Antitrust Policy in Aftermarkets", with Severin Borenstein and Jeffrey K. MacKie-Mason, FTC/DOJ/ABA Conference on Post-Chicago Economics, Washington, D.C., May 1994.

"The Effect of Price-Fixing by Institutions of Higher Education, University of Delaware, May 1994.

"The Effect of Futures Markets and Corners on Storage and Spot Price Variability", Purdue University, February 1994.

"An Empirical Test of the Effect of Basis Risk on Cash Market Positions", University of California at Davis, February 1993.

Discussant, Econometrics Association, Anaheim, 1992 Annual Meetings.

"Testing the Principle of Minimum Differentiation: Airline Departure-Time Crowding", Econometrics Association, Washington, D.C., 1990 Annual Meetings.

Consulting and Testifying

In re Photochromic Lens Antitrust Litigation, 2010-2012
United States District Court Middle District of Florida, Tampa Division, No. 8:10-md-02173-JDW-EAJ
Testifying expert for plaintiffs
Deposed August 2012

Datel Holdings and Datel Design and Development v. Microsoft, 2010-2011
United States District Court, Northern District of California, San Francisco Division, No. 09-cv-05535
Testifying expert for plaintiffs
Deposed October 2011

In re Prefilled Propane Tank Marketing and Sales Practices Litigation, 2010-2011
United States District Court, Western District of Missouri, Western Division, No. 4:09-cv-00465
Testifying expert for plaintiffs

In re Florida Cement and Concrete Antitrust Litigation, 2010
United States District Court, Southern District of Florida, Miami Division, No. 1:09-cv-23493-CMA
Consulting expert for plaintiffs

Altair Engineering v. MSC Software, 2009-2010
United States District Court, Eastern District of Michigan, Southern Division, No. 2:07-cv-12807
Testifying expert for plaintiffs
Deposed May 2010

In re Optical Disk Drive products Antitrust Litigation, 2009-2010
United States District Court, Northern District of California, San Francisco Division, No. M:2010-cv-02143
Consulting expert for plaintiffs

In re Flash Memory Antitrust Litigation, 2008-2011
United States District Court, Northern District of California, Oakland Division, No. C-07-0086-SBA
Testifying expert for plaintiffs
Deposed August 2009

Valassis Communications, Inc. v. News America, Inc., 2008-2009
United States District Court, Eastern District of Michigan, Southern Division, No. 2:06-cv-10240
Circuit Court of the State of Michigan, County of Wayne, No. 07-0706645-CZ
Consulting expert for plaintiffs

In re TFT-LCD (Flat Panel) Antitrust Litigation, 2008-present
United States District Court, Northern District of California, San Francisco Division, No. M:07-cv-01827
Testifying expert for plaintiffs
Deposed July 2009, June 2010, June 2011, August 2011

Houston Baptist University v. NCAA, 2008-2009
United States District Court in and for the Southern District of Texas, Houston Division
Testifying expert for plaintiffs

Seoul Semiconductor Co. v. Nichia Corp., 2008
United States District Court, Northern District of California, No. 3:08-cv-04932-PJH
Testifying expert for plaintiffs

Albert Andy Cohn v. Office Depot, 2008
Superior Court of the State of California, County of Los Angeles, Central District, No. BC 372449
Testifying expert for defendants

In re Graphics Processing Units Antitrust Litigation, 2007-2008
United States District Court Northern District of California, No. M:07-CV-01826-WHA
Testifying expert for plaintiffs
Deposed June 2008

Pro-Sys Consultants Ltd. and Neil Godfrey v. Microsoft, 2007-present
Supreme Court of British Columbia, No. L043175, Vancouver Registry
Testifying expert for plaintiffs
Deposed December 2008

In re Dynamic Random Access Memory (DRAM) Antitrust Litigation, 2007
United States District Court, Northern District of California, No. 02-cv-01486
Consulting expert for plaintiffs

Jason White et al. v. NCAA, 2006-2008
United States District Court Central District of California, No. CV 06-0999 RGK (MANx)
Testifying expert for plaintiffs
Deposed October 2007

Kleppner et al. v. Unocal, 2004-2008
In re Reformulated Gasoline (RFG) Antitrust and Patent Litigation
United States District Court Central District of California, No. 05-1671 CAS
Testifying expert for plaintiffs
Deposed December 2006

Carlisle, settlement negotiations with Crompton, EPDM price-fixing cartel, 2005-2007
Consulting expert

Caterpillar and Carlisle, settlement negotiations with DuPont-Dow Elastomers, PCP (or CR) and EPDM price-fixing cartels, 2004-2005
Consulting expert

City and County of San Francisco et al. v. Microsoft, 2004-present
United States District Court for the District of Maryland, No. 1332
Testifying expert for plaintiffs

The Service Source v. Office Depot, 2004-2005
United States District Court Eastern District of Michigan Southern Division, No. 02-73361
Project director

Joe Comes et al. v. Microsoft, 2002-2008
Iowa District Court for Polk County, No. CL82311
Testifying expert for plaintiffs
Deposed July 2006, November 2006

Charles Cox et al. v. Microsoft, 2002-2006
Supreme Court of the State of New York County of New York, No. 105193/00
Testifying expert for plaintiffs

Daniel Gordon et al. v. Microsoft, 2002-2004
State of Minnesota District Court County of Hennepin Fourth Judicial District, No. 00-5994
Testifying expert for plaintiffs
Deposed September 2003

Morelock Enterprises, Inc. v. Weyerhaeuser Co., 2004-2008
United States District Court District of Oregon, No. 3:04-cv-00583-PA
Testifying expert for plaintiffs
Deposed October 2004, April 2005, October 2007
Testified in trial April 2008

Compuware v. IBM, 2002-2005
United States District Court for the Eastern District of Michigan, No. 02-70906
Project director

Lingo et al. v. Microsoft, 1999-2004
Superior Court of the State of California City and County of San Francisco, J.C.C.P. No. 4106
Project director
In re New Mexico Indirect Purchaser Microsoft Corp. Antitrust Litigation, 2002-2004
State of New Mexico First Judicial District, No. D-0101-CV-2000-1697
Testifying expert for plaintiffs

Charles Friedman et al. v. Microsoft, 2002-2004
Superior Court of the State of Arizona in and for the County of Maricopa, No. CV2000-000722 / CV2000-005872
Testifying expert for plaintiffs
Deposed September 2003

In re Massachusetts Consumer Protection Litigation, 2003-2004
Commonwealth of Massachusetts, Superior Court Department of the Trial Court Middlesex Division, No. 00-2456
Consulting expert

Olson v. Microsoft, 2002
Montana First Judicial District Court Lewis & Clark County, No. CDV-2000-219
Consulting expert

Covad v. Bell Atlantic (Verizon), 2001-2004
United District Court for the District of Columbia, No. 99-1046
Project director

AMD, 2000-2004
Project director

Gravity et al. v. Microsoft, 1999-2003
United States District Court for the District of Columbia, No. 1:99CV00363
Staff economist

Leckrone, et al. v. Premark International, Inc., et al., 2001
Testifying expert for plaintiffs

Ren, et al. v. EMI Music Distribution, Inc., 2001
State of Michigan in the Circuit Court of the County of Macomb, No. 00-2383-CZ
Testifying expert for plaintiffs

SBC, 2000
Staff economist

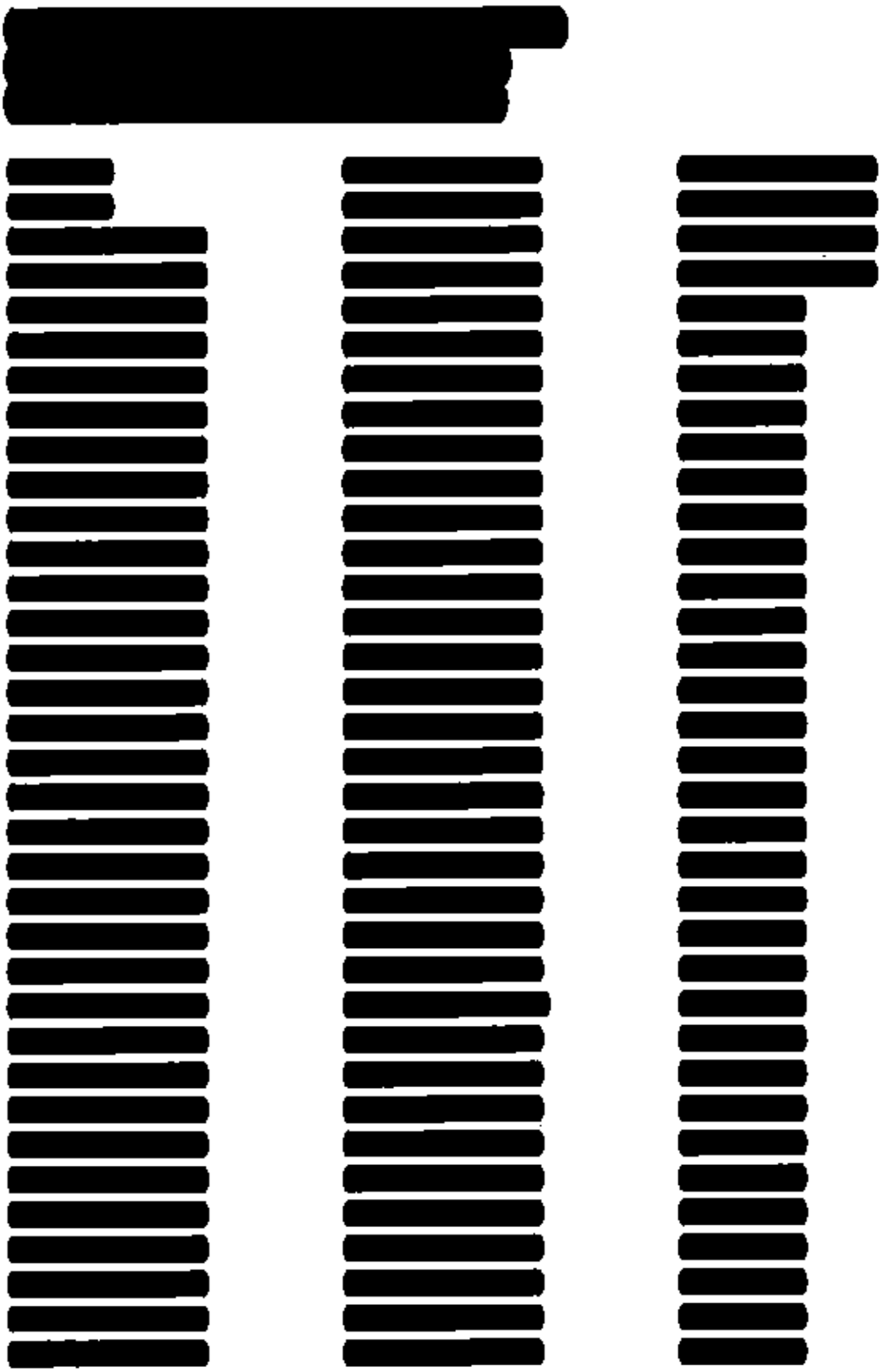
City and County of San Francisco, 1999
Staff economist

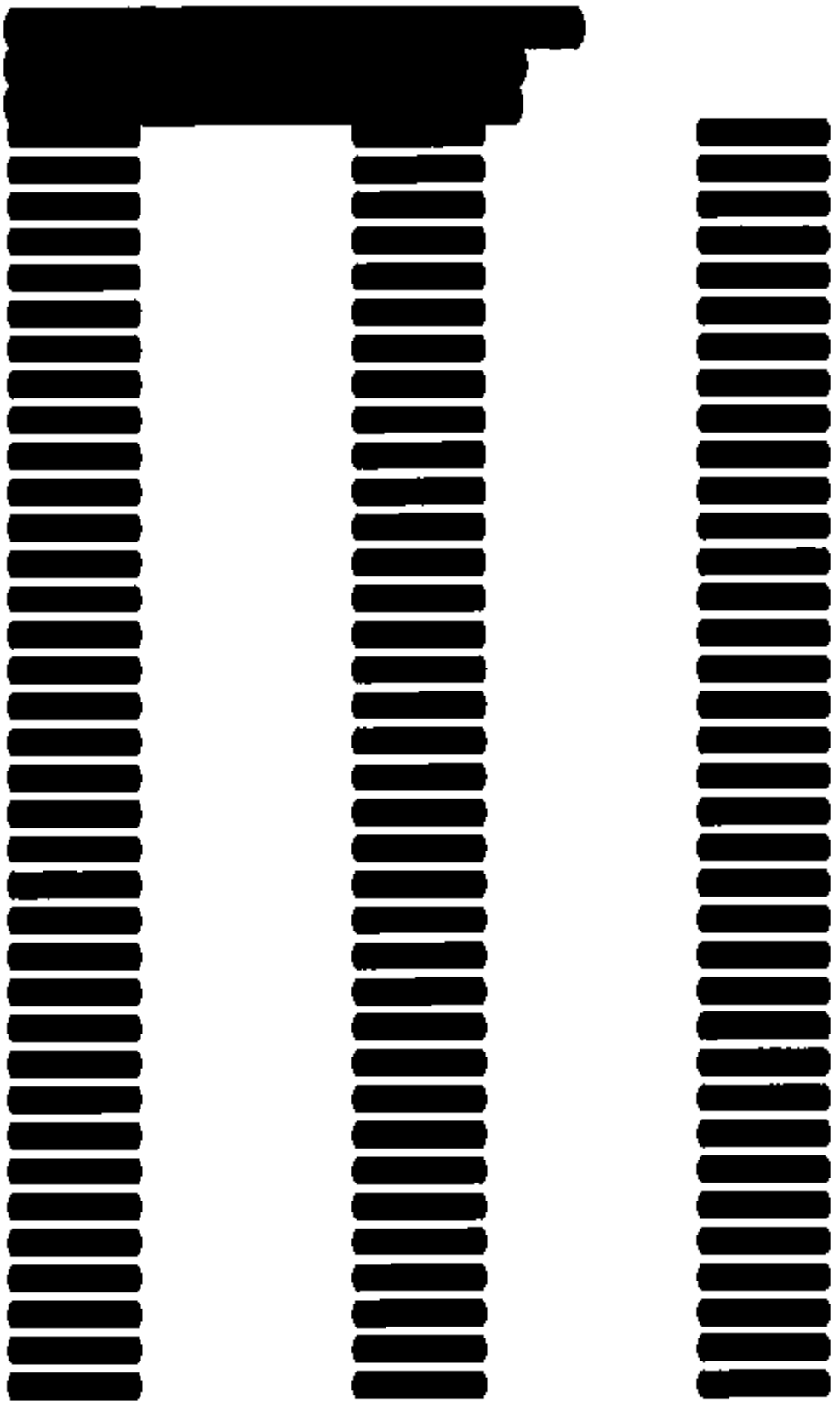
Intergraph v. Intel, 1998-2001
United States District Court Appeals for the Federal District, No. 98-1308
Staff economist

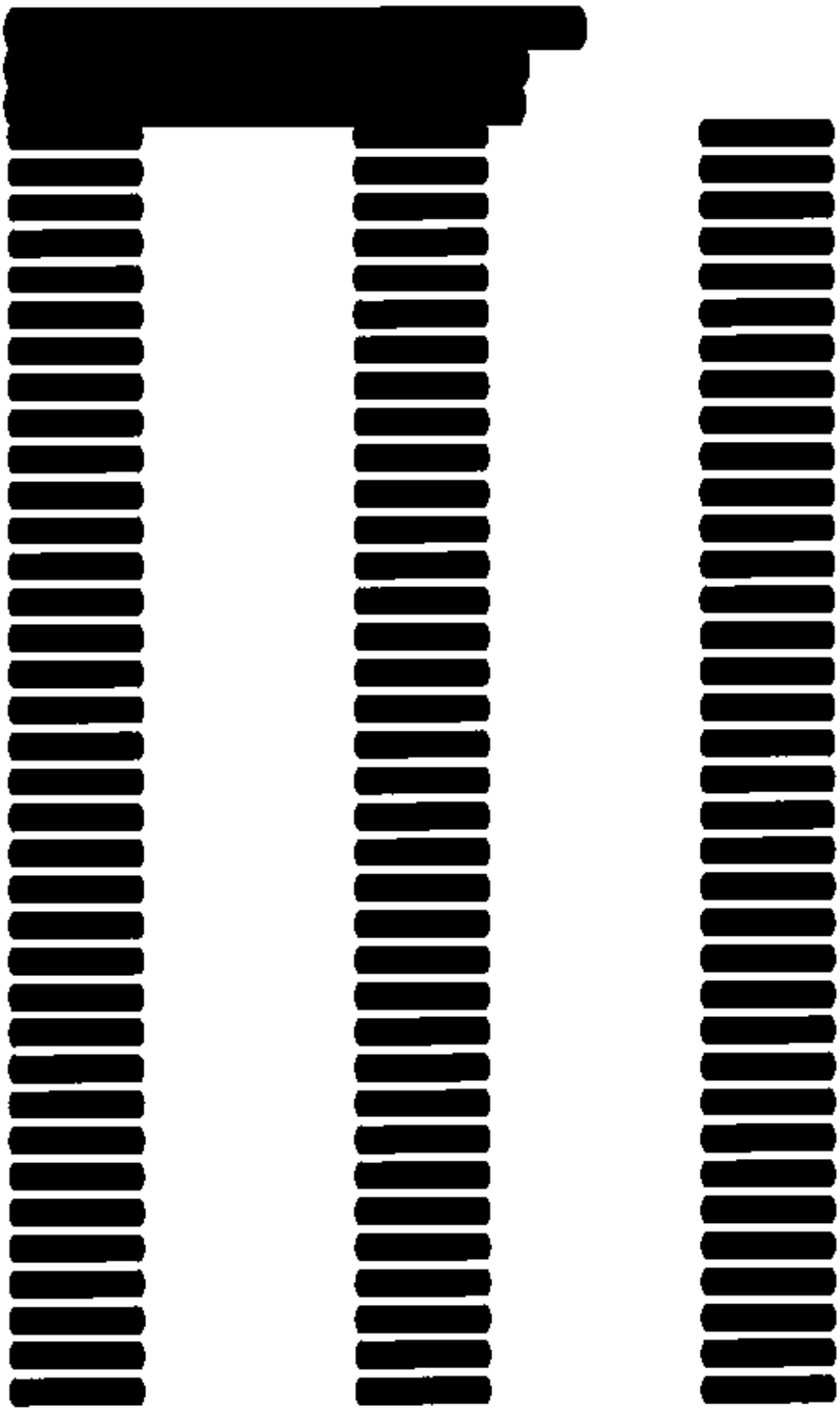
Comm-Tract v. Northern Telecom, 1991-1997
United States District Court District of Massachusetts, No. 90-13088-WF
Project director

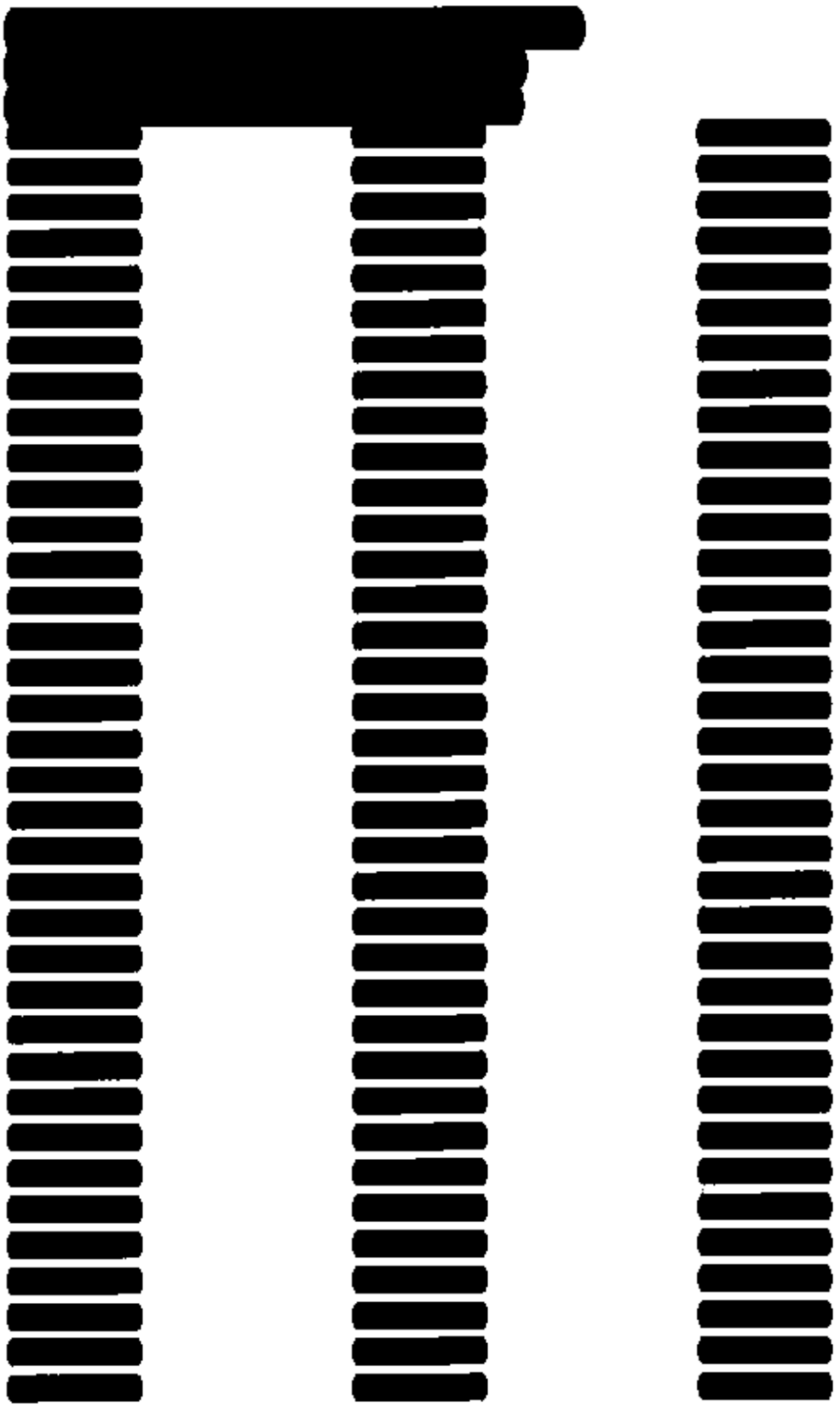
Systemcare, Inc. v. Wang Computer, 1991-1993
United States District Court for the District of Colorado, No. 89-B-1778
Staff economist

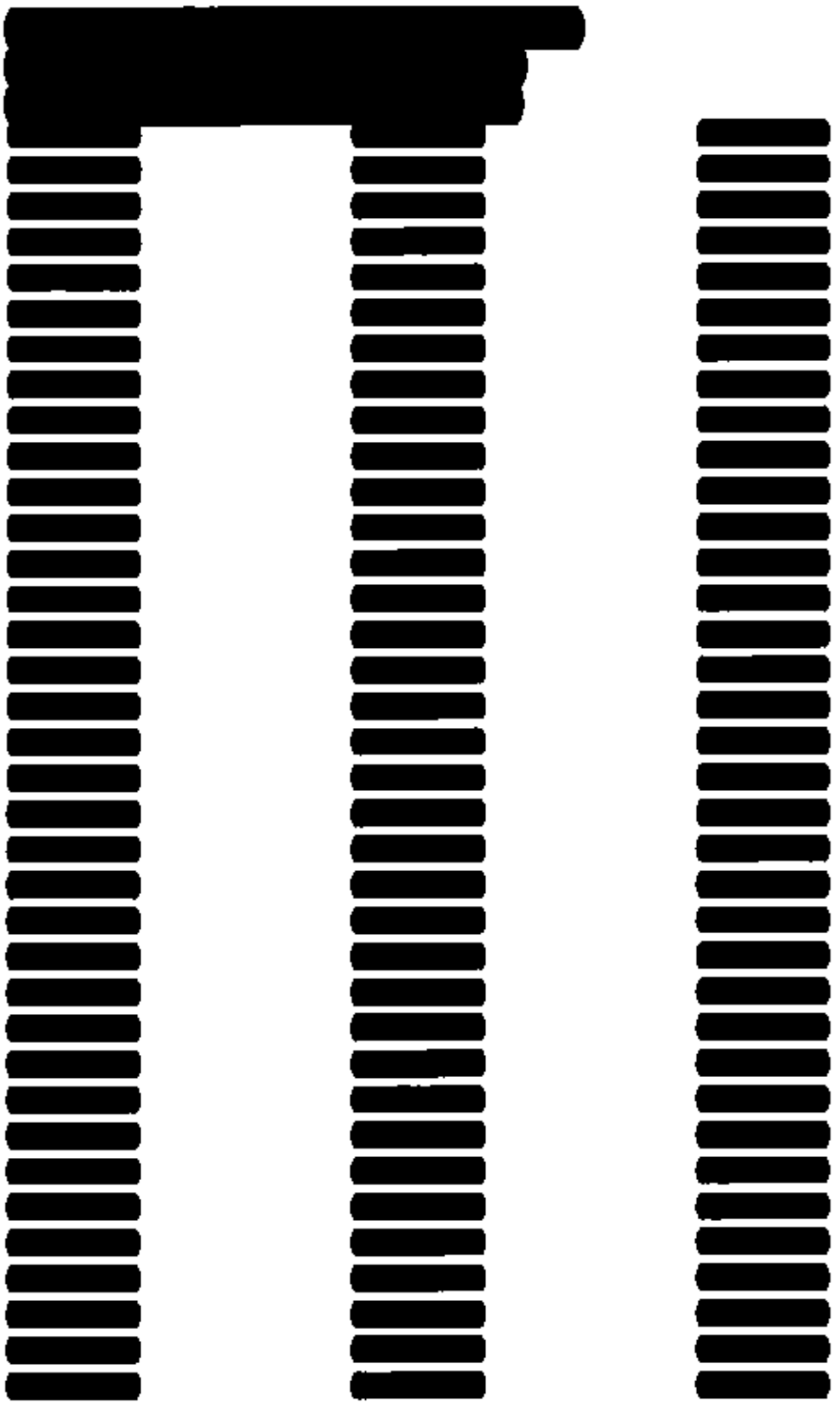
International Travel Arrangers v. Northwest Airlines, 1988-1989
Staff economist

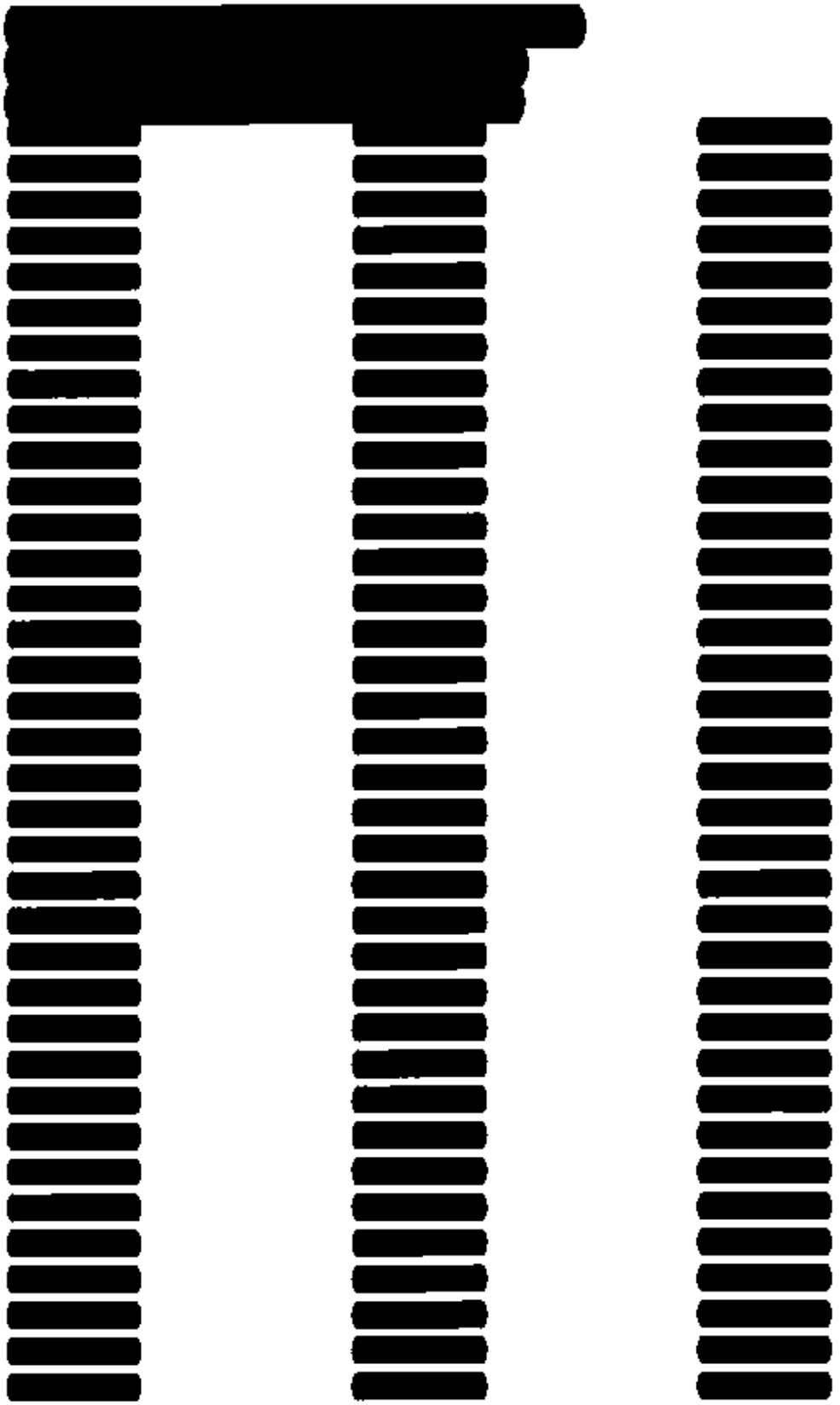


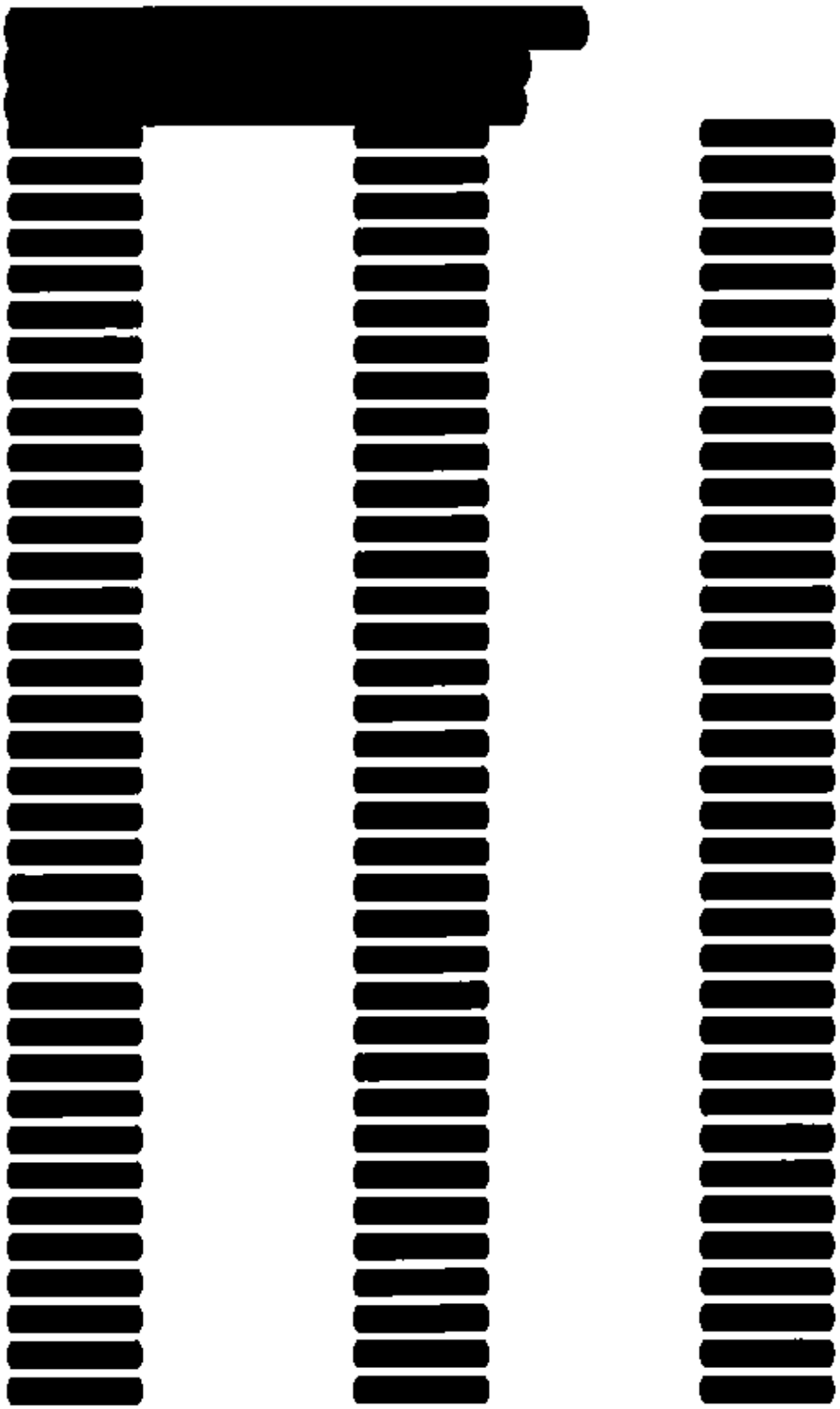


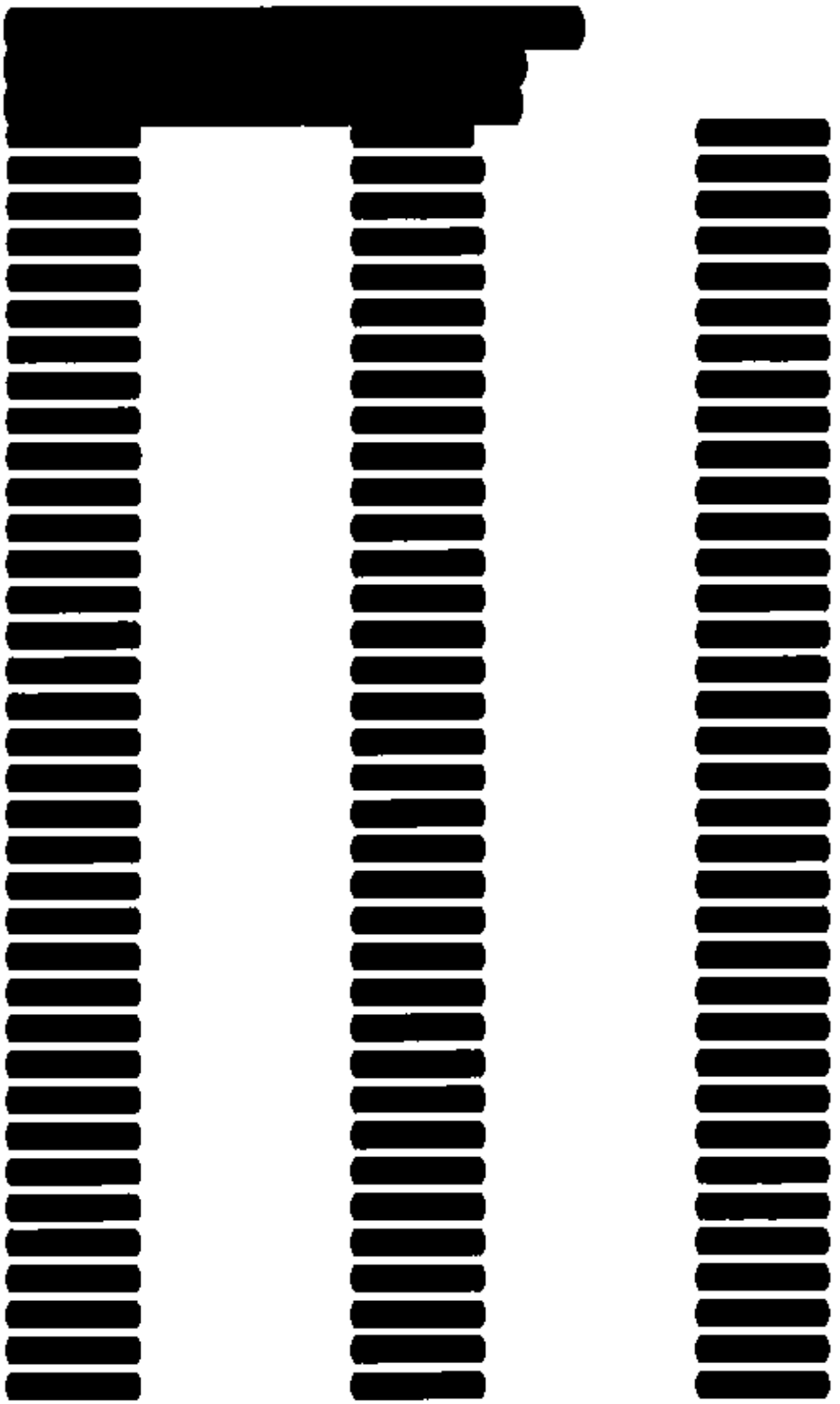


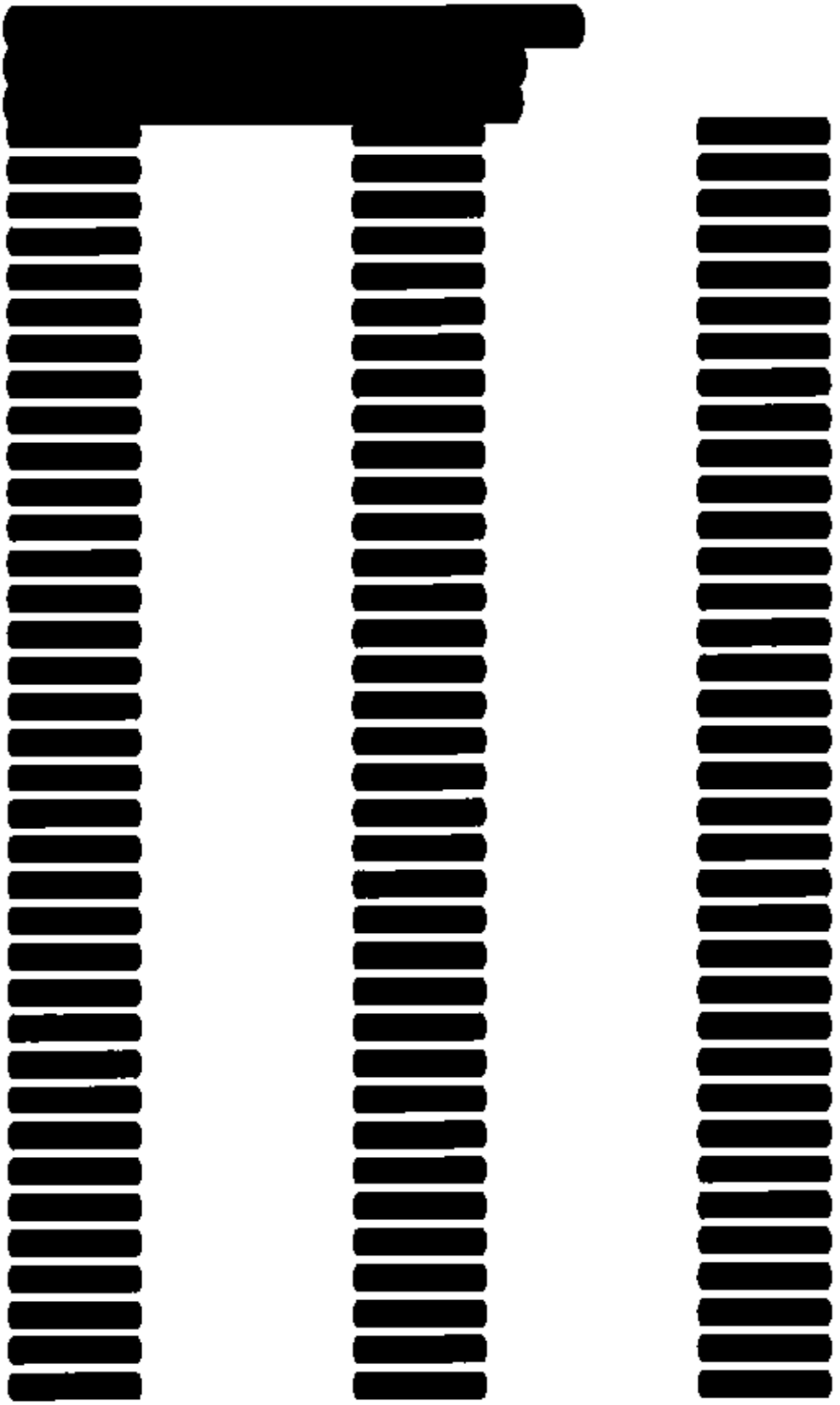


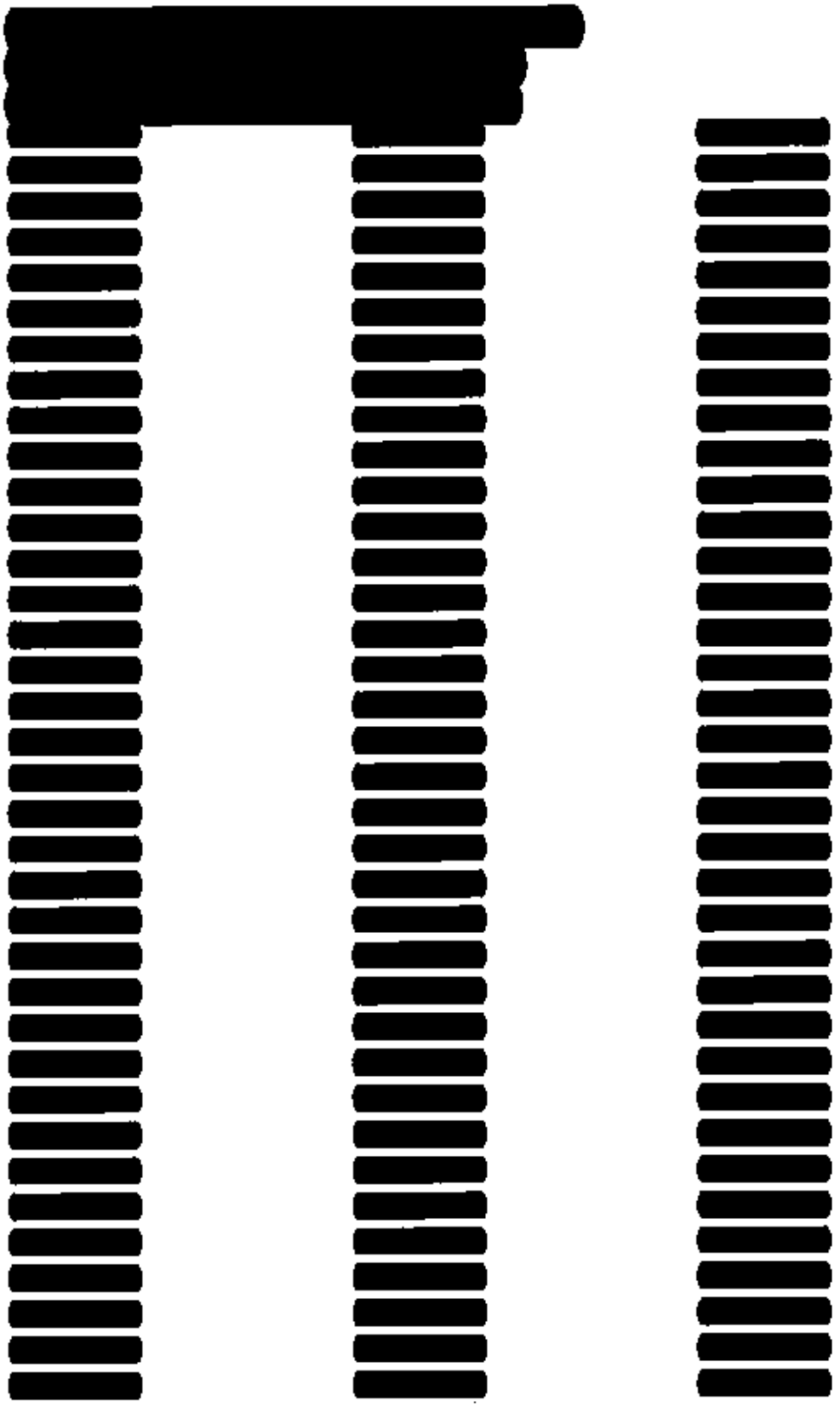


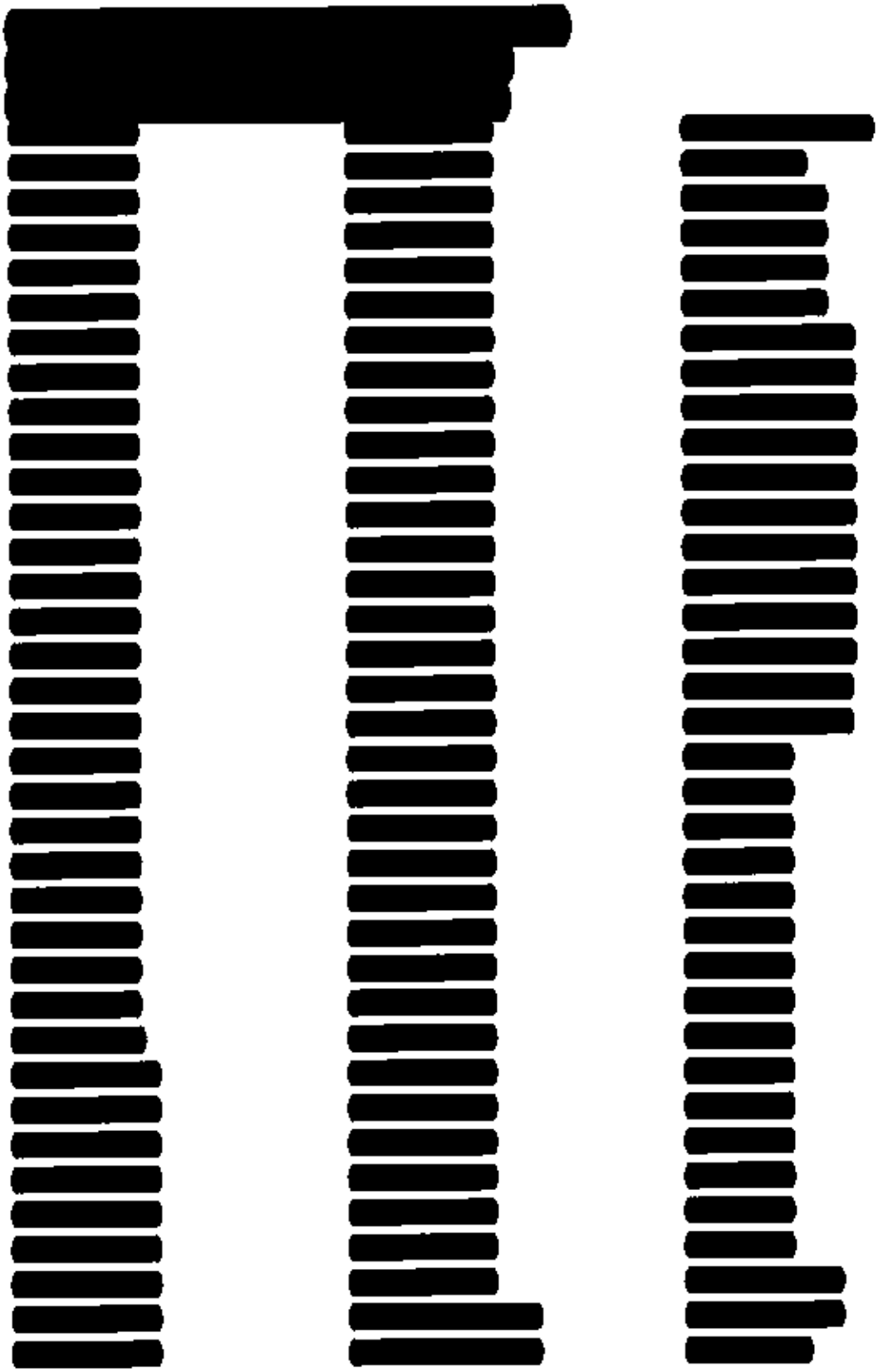


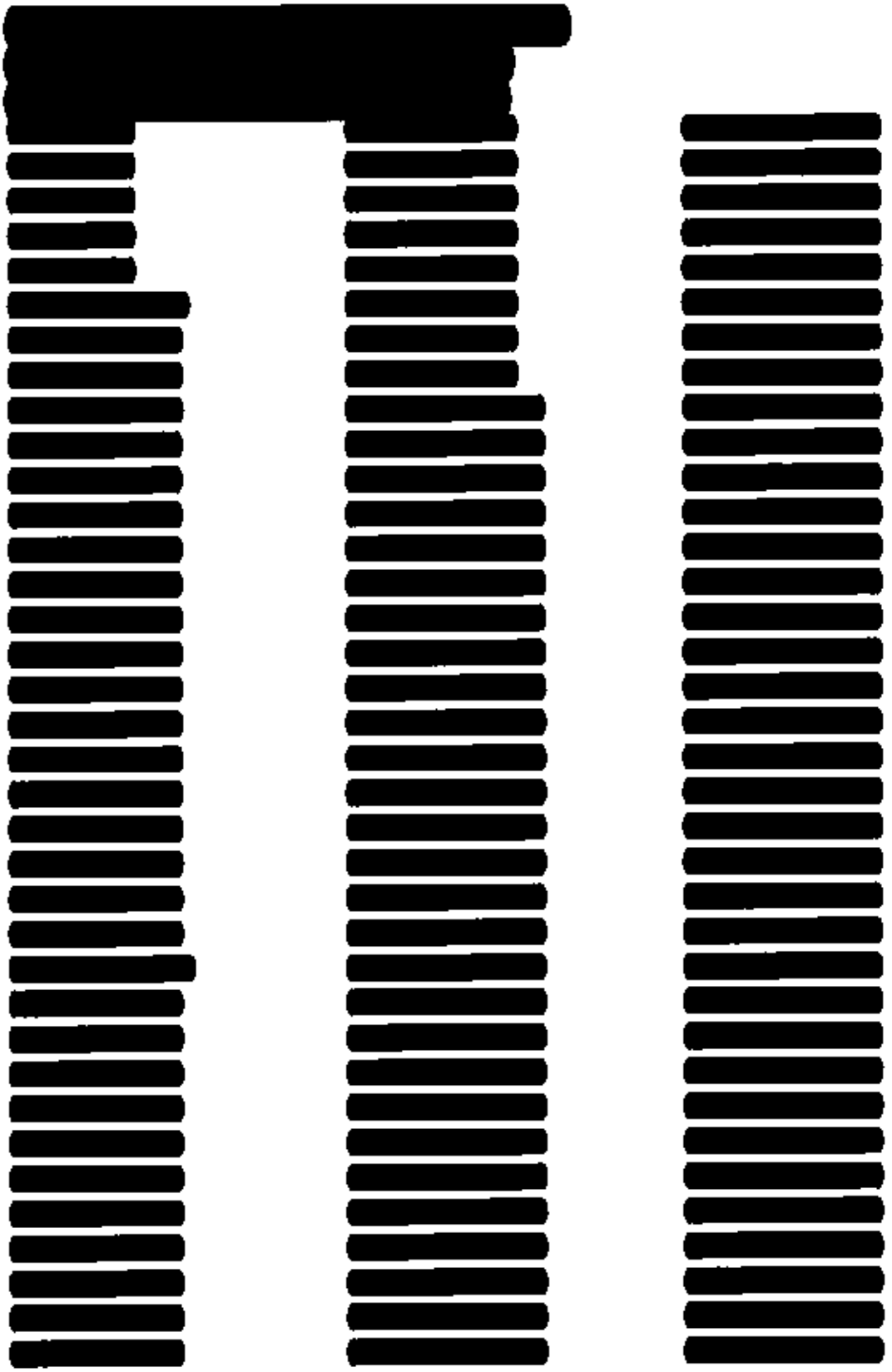


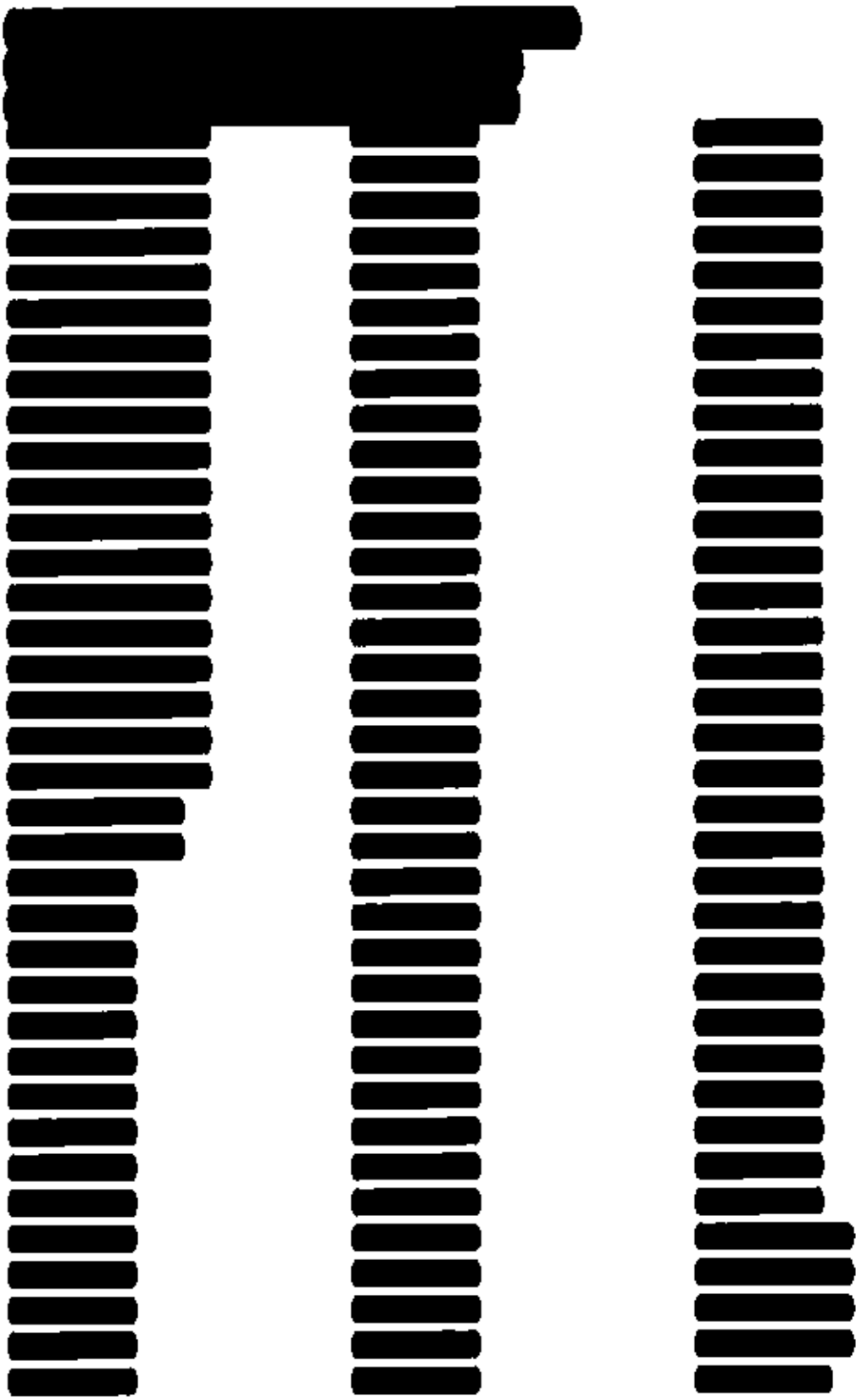


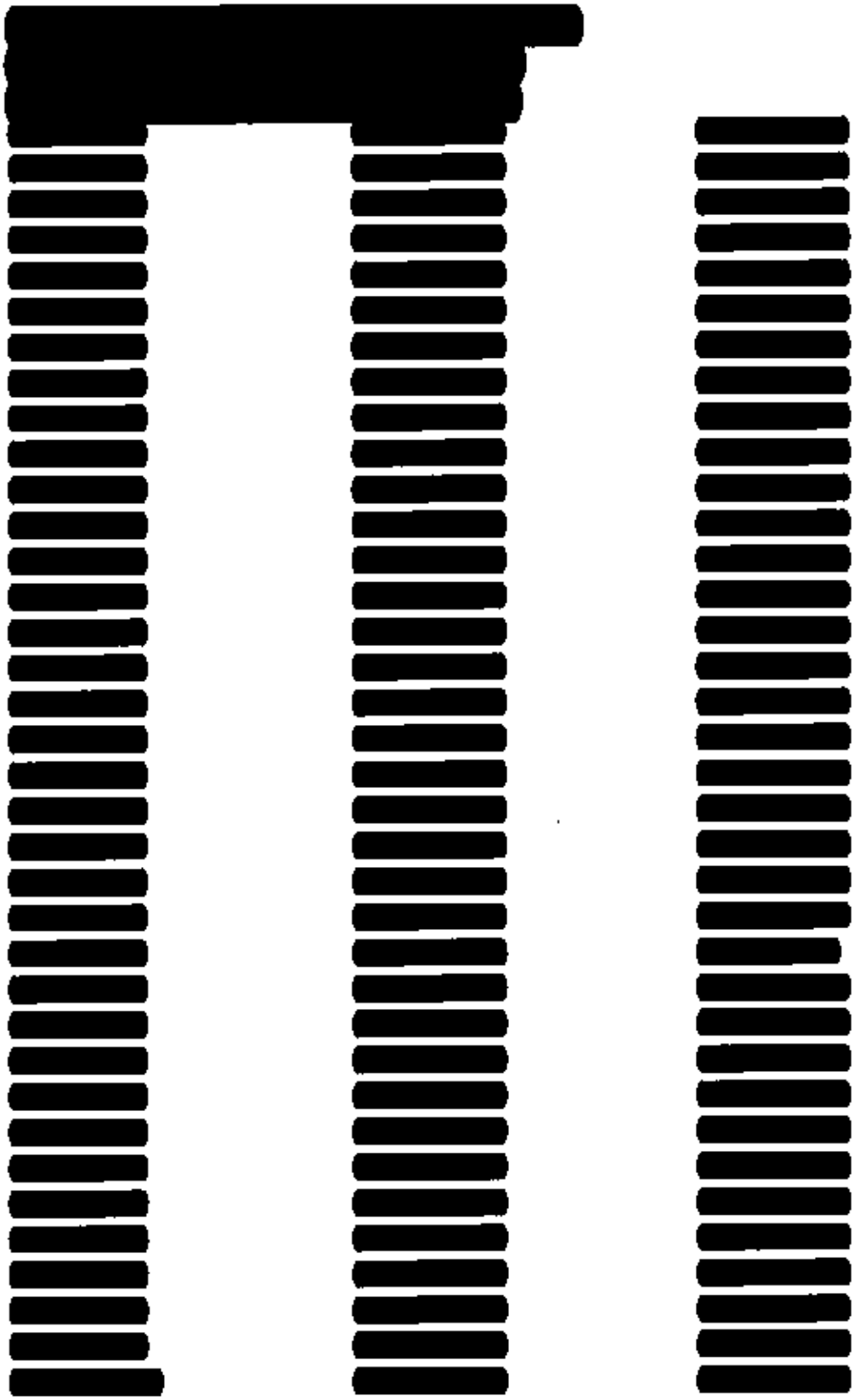


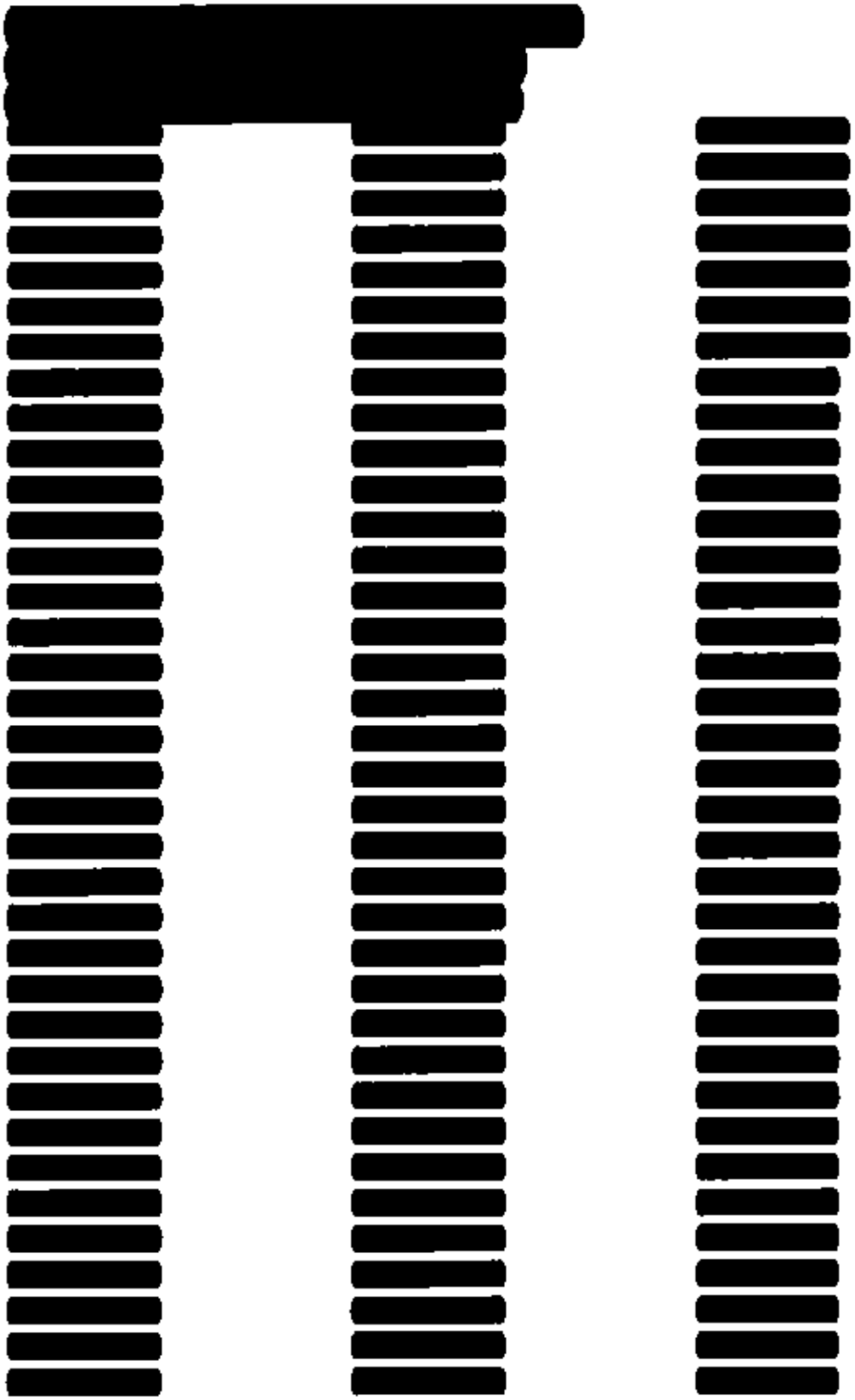


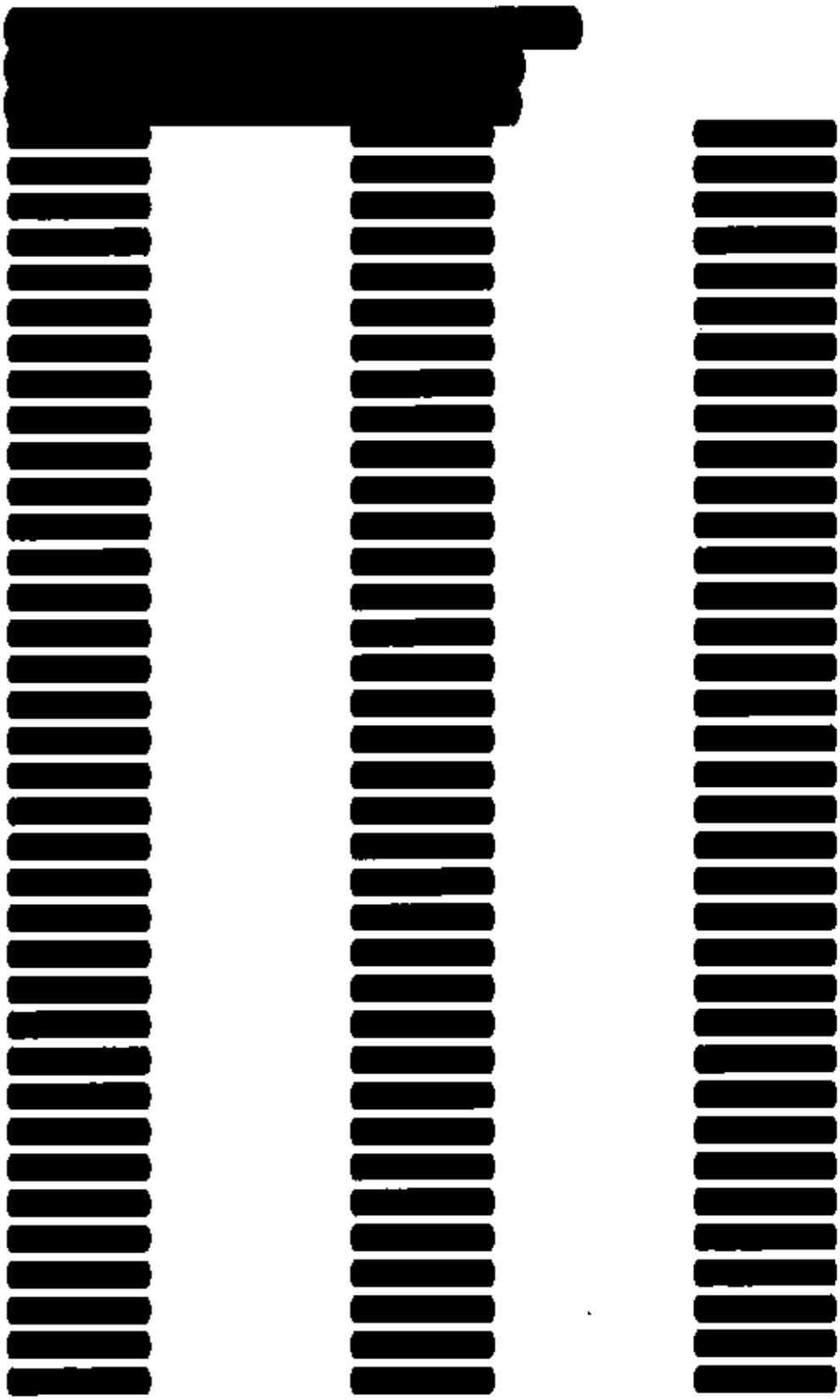


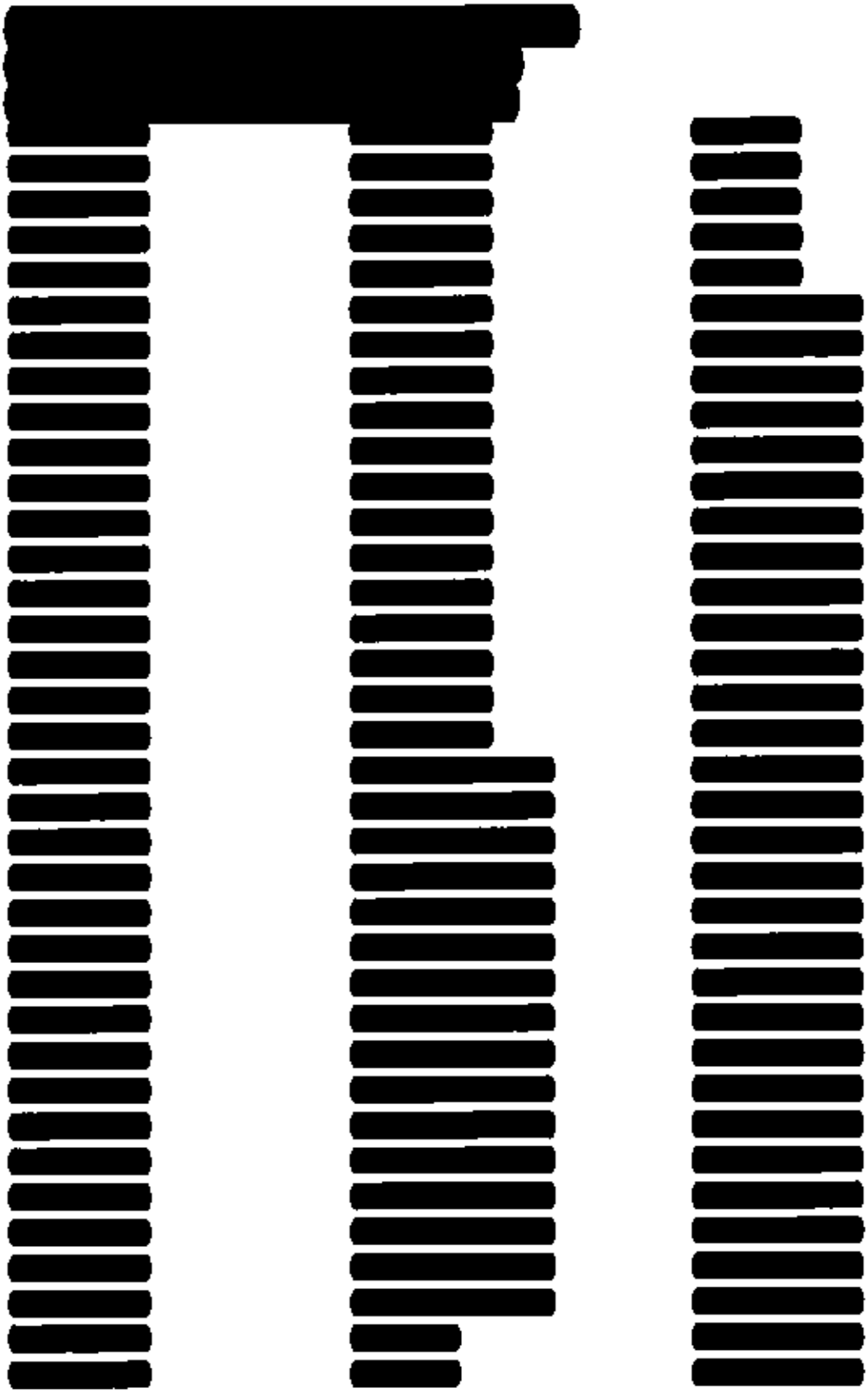


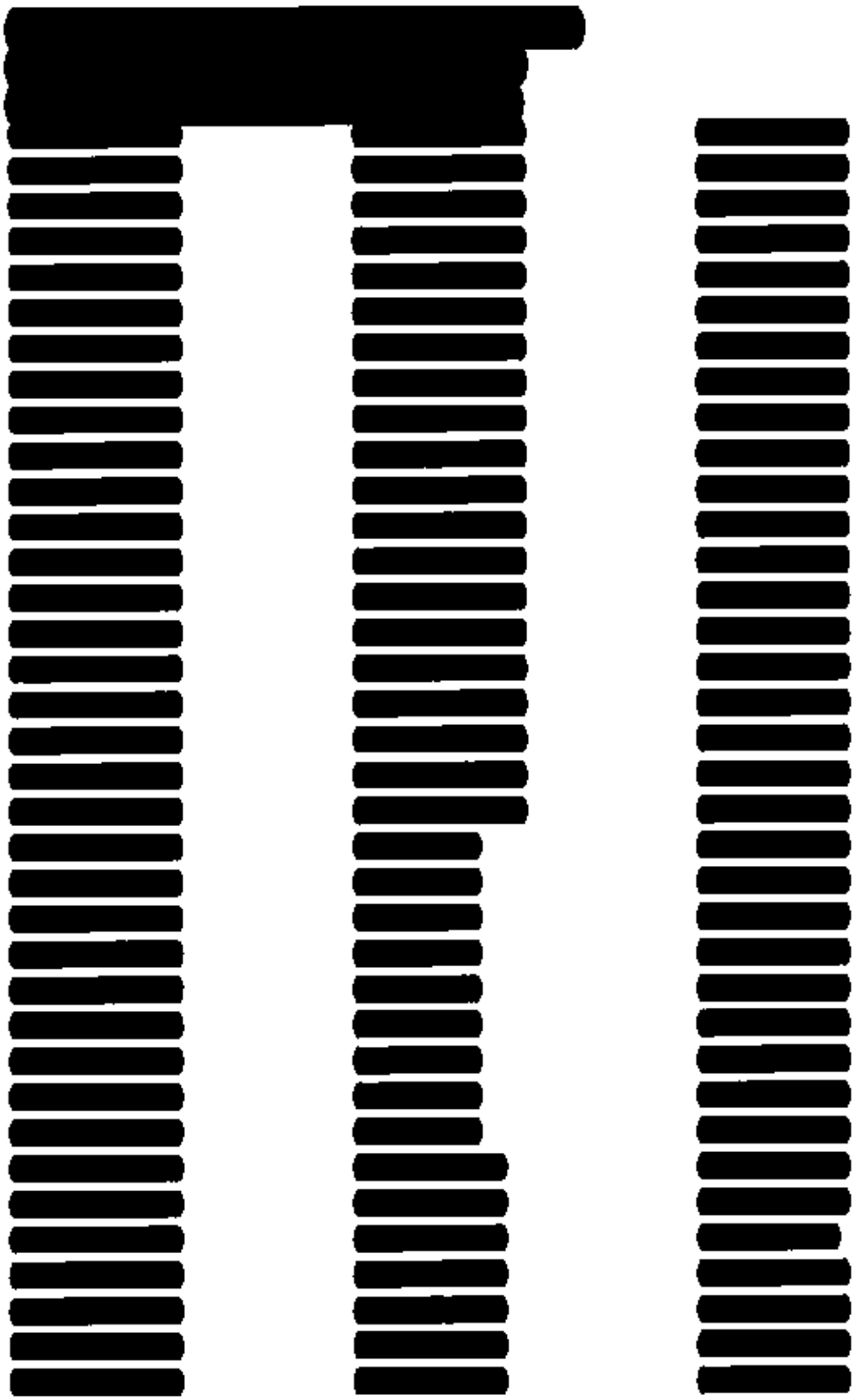


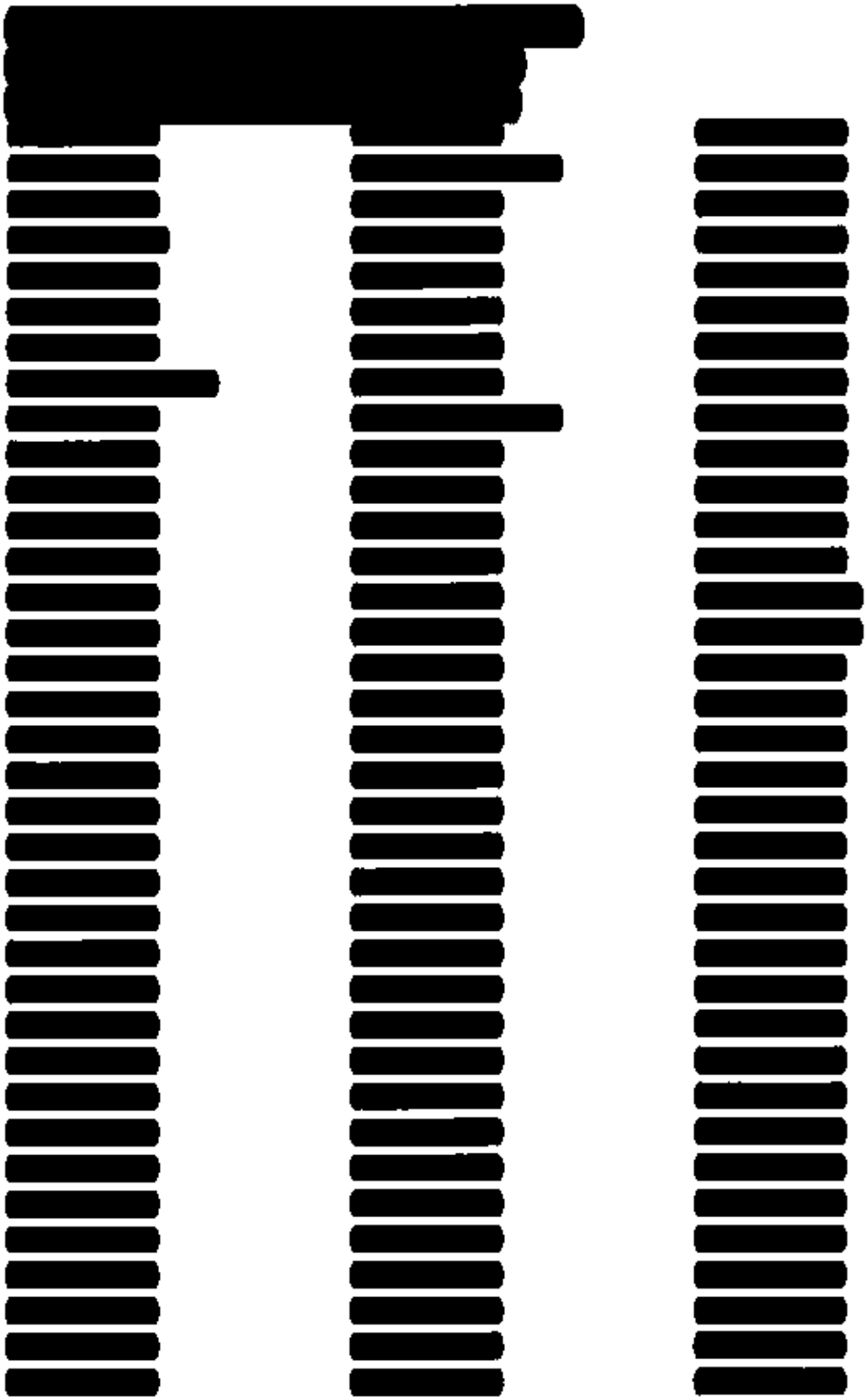


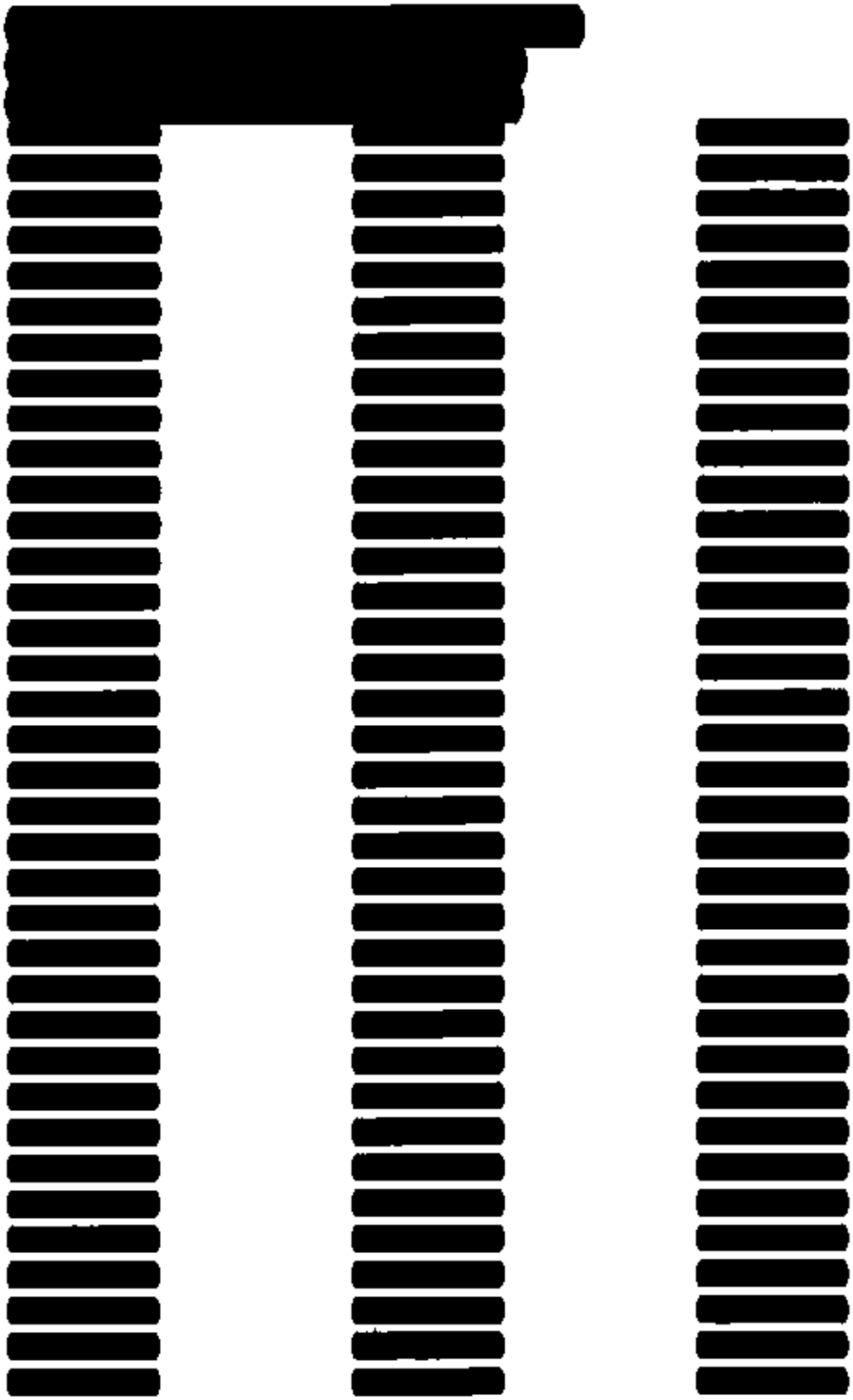


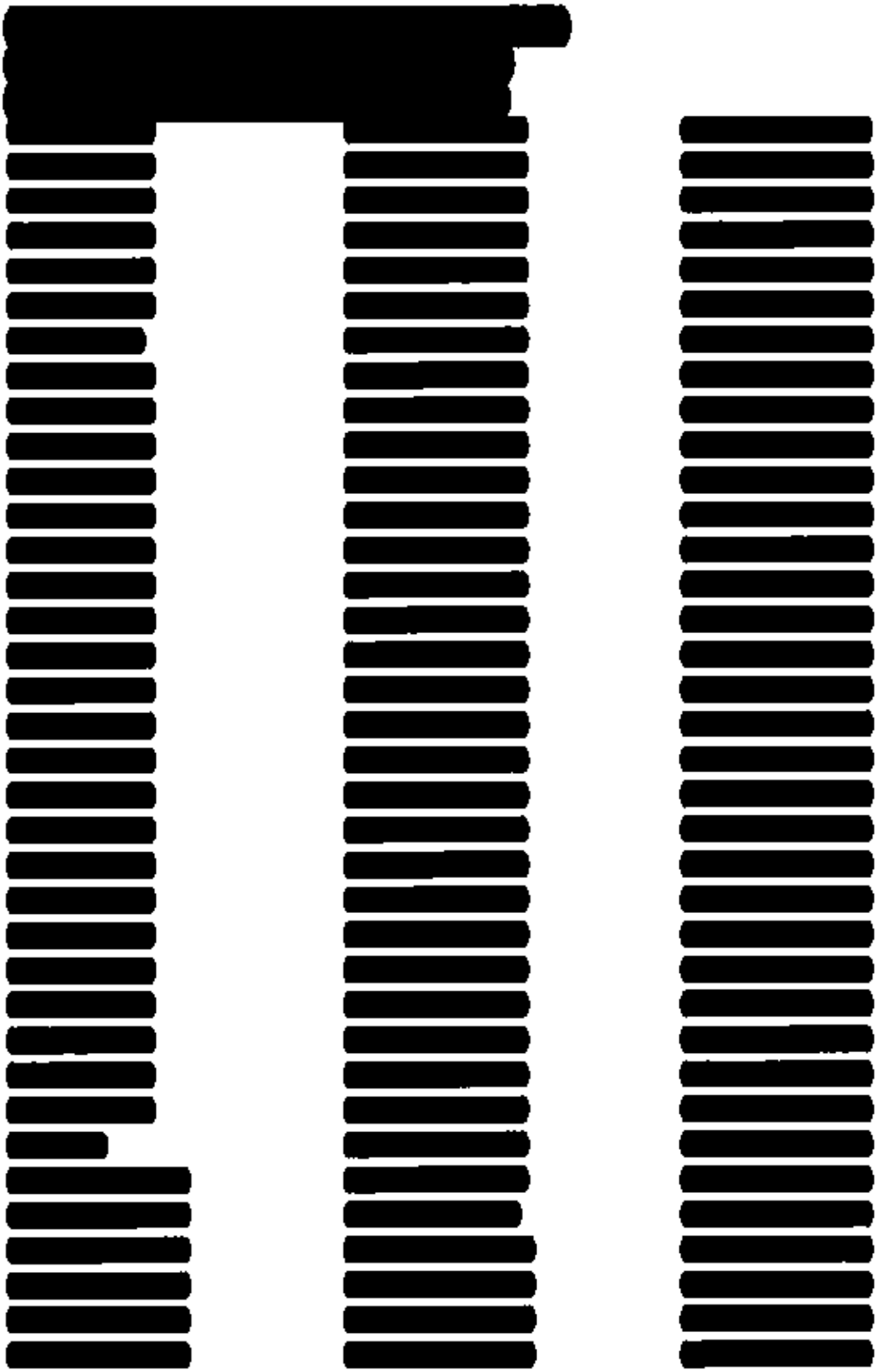


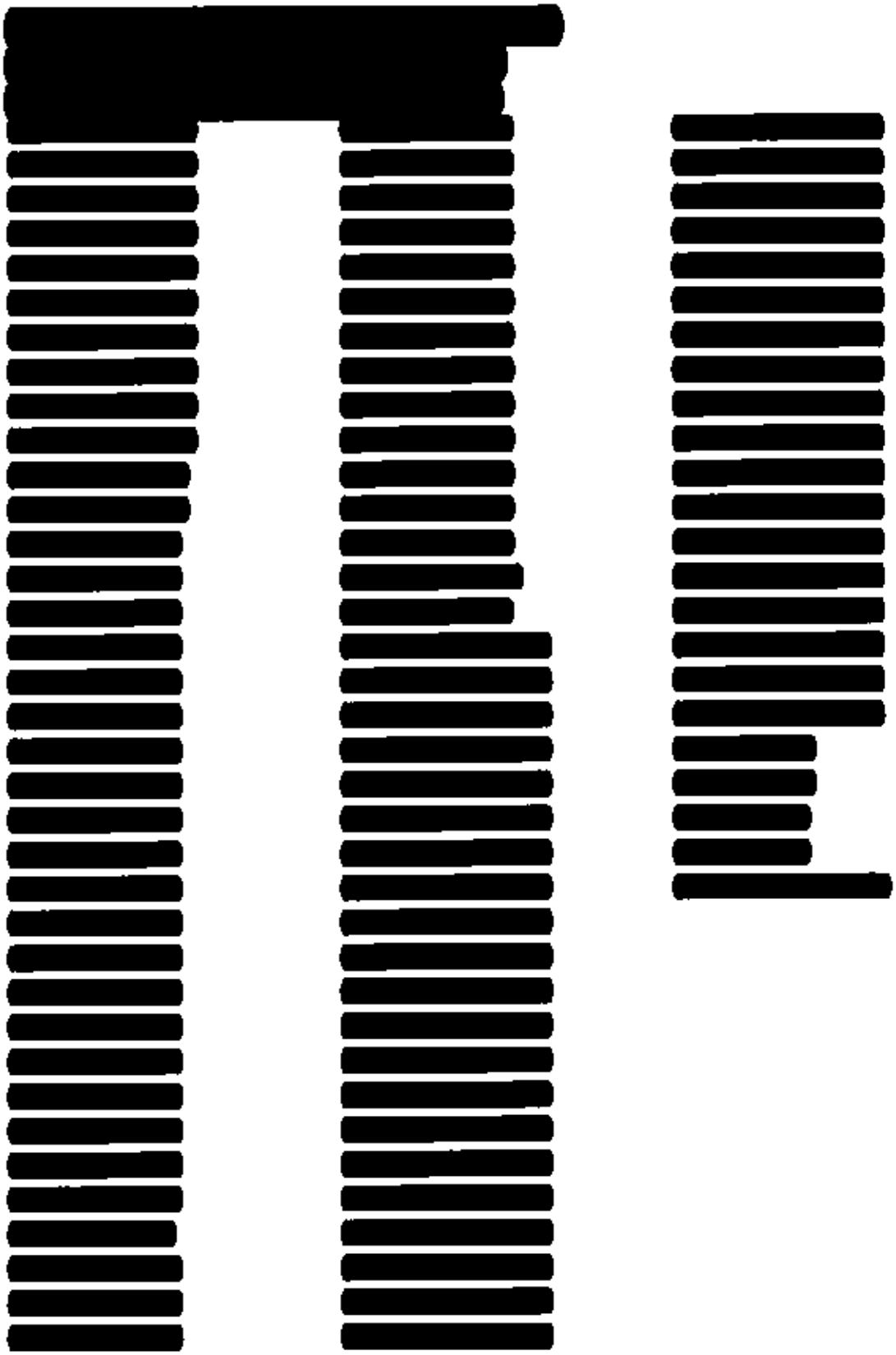












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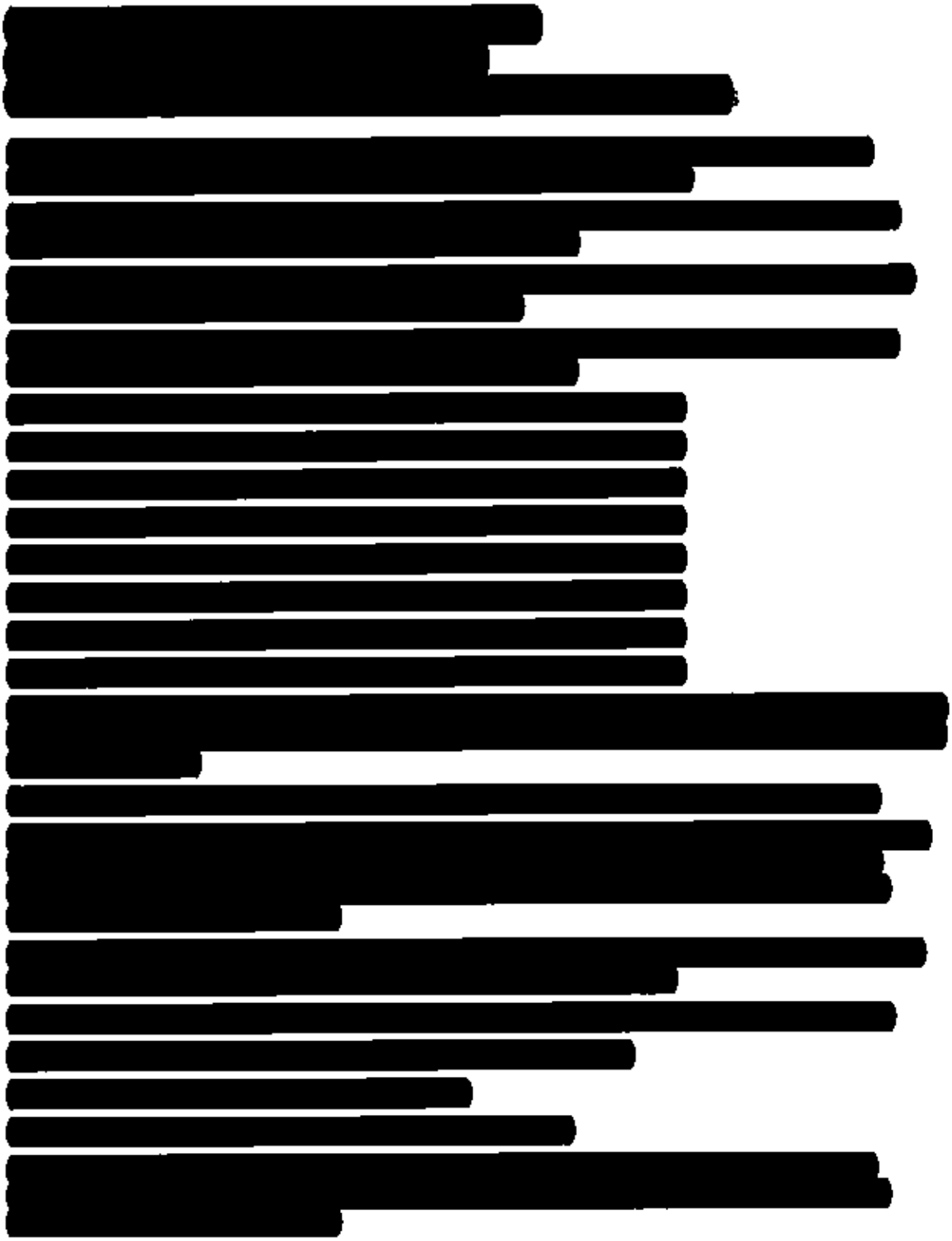

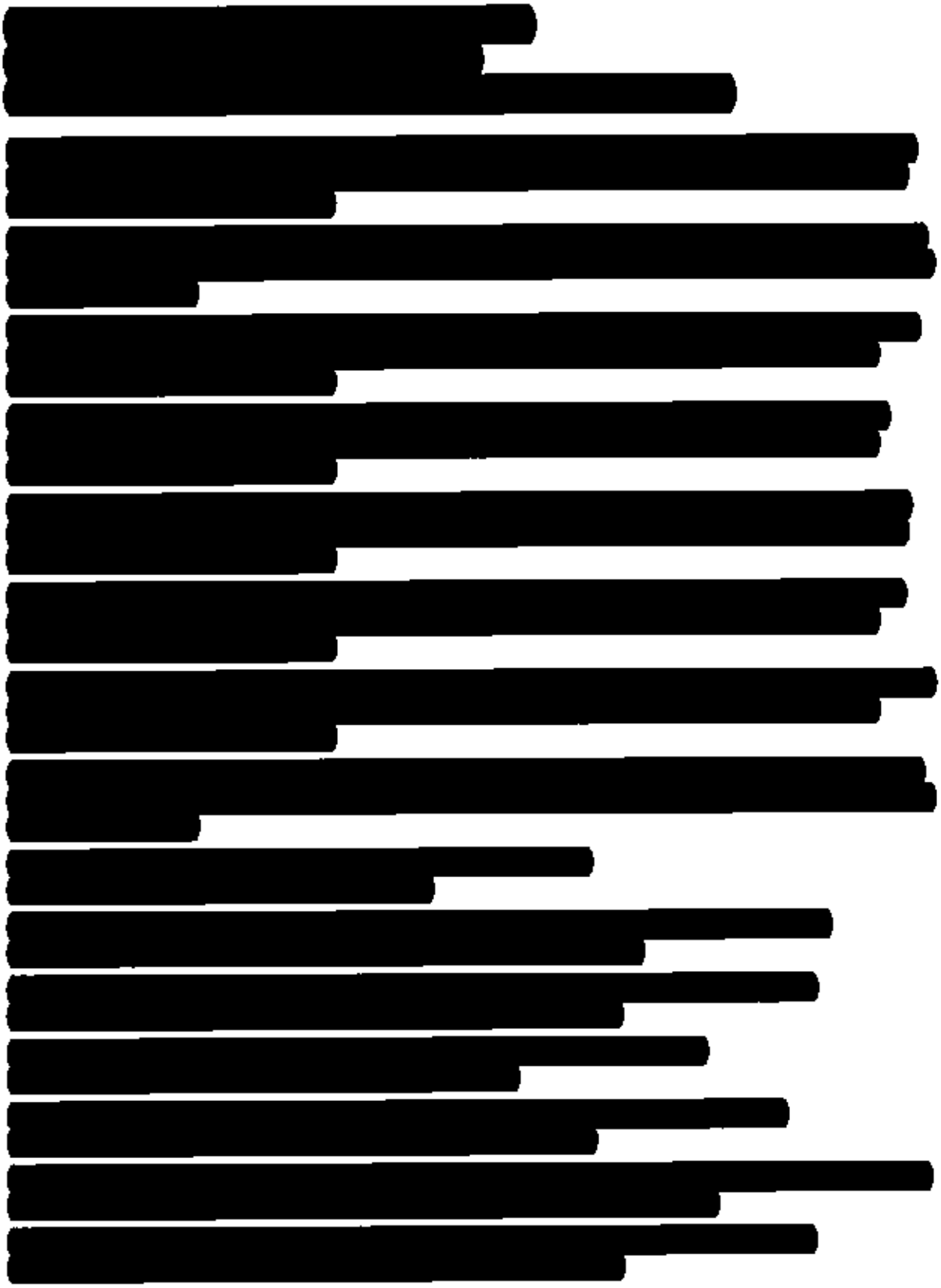

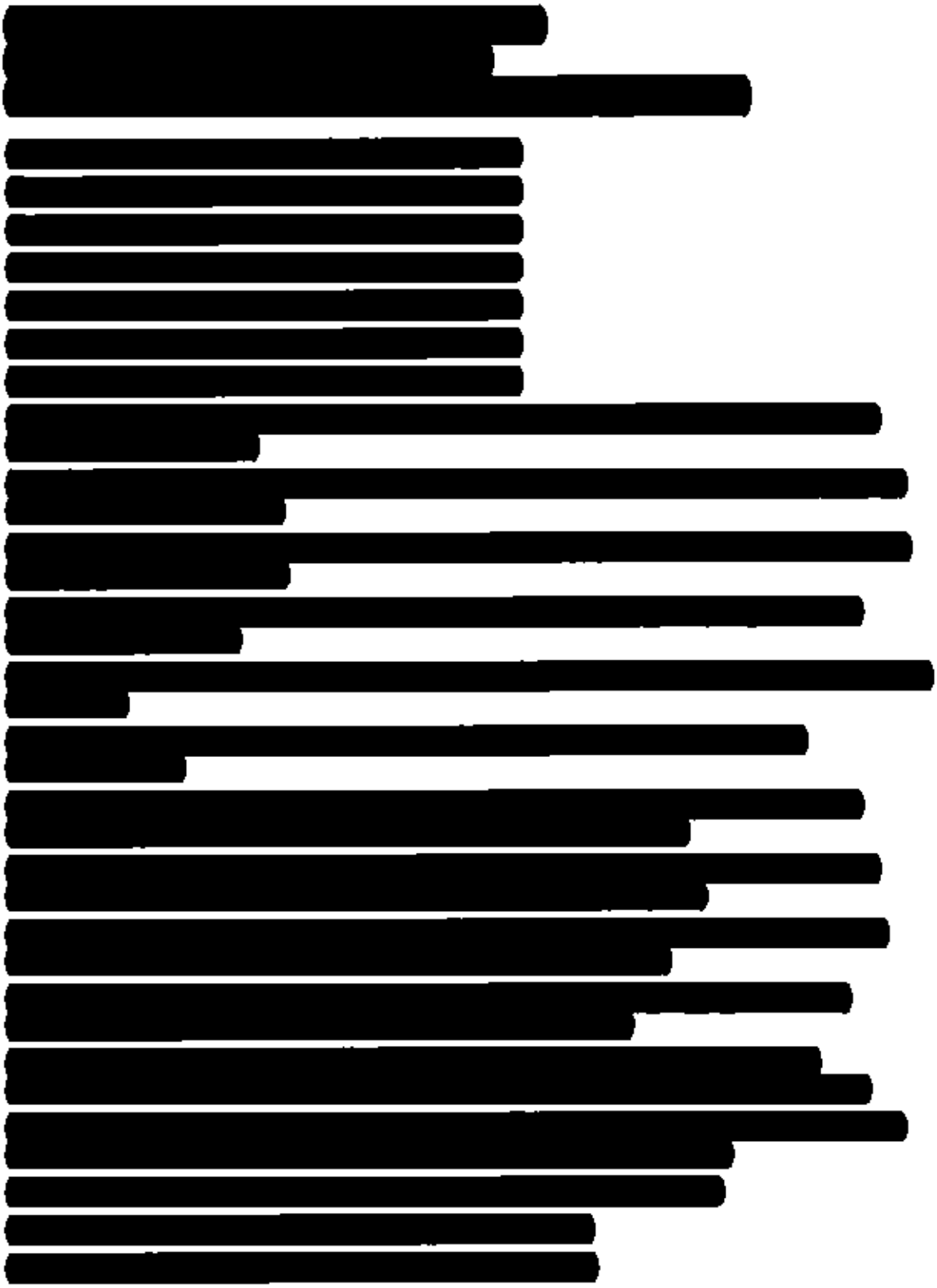

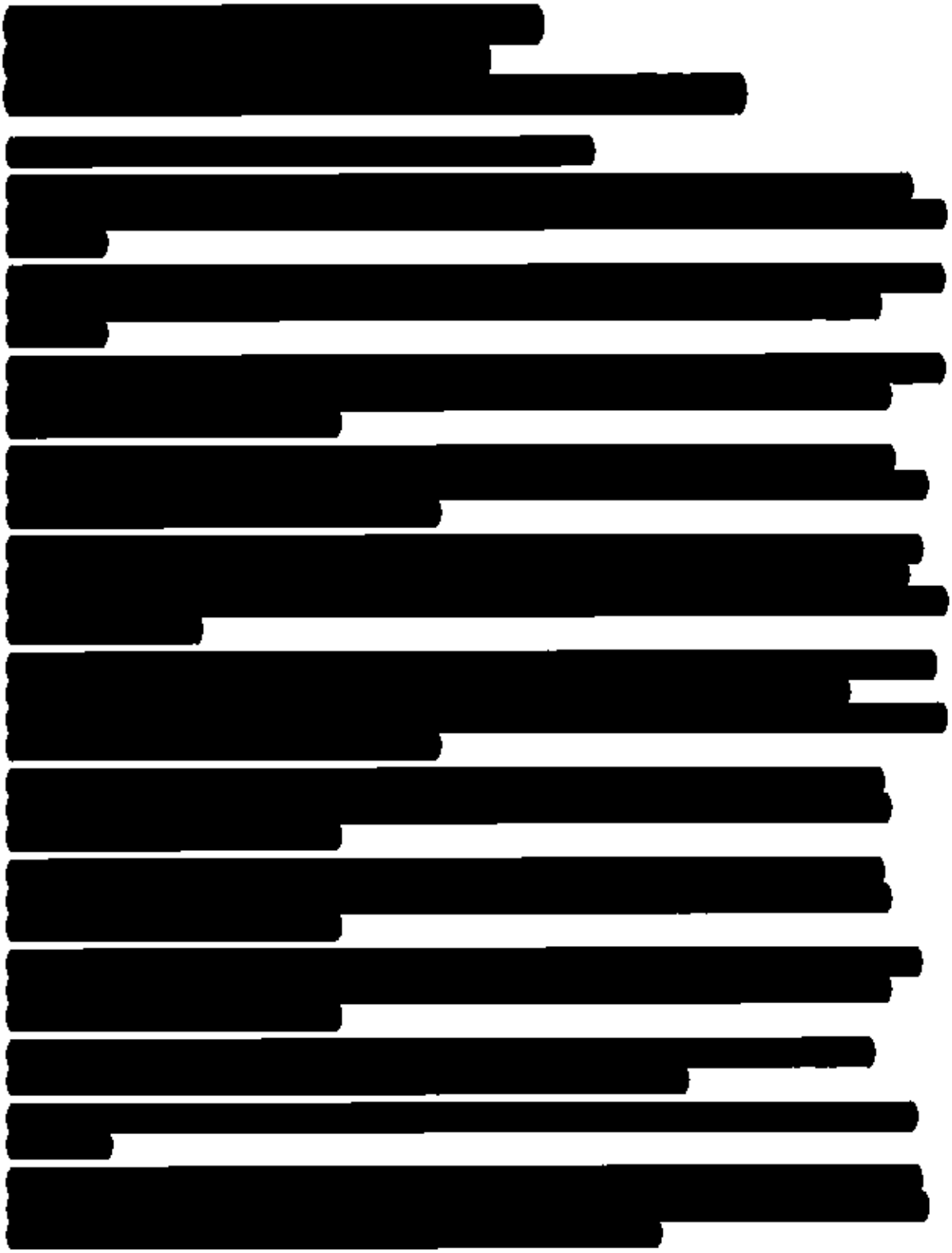

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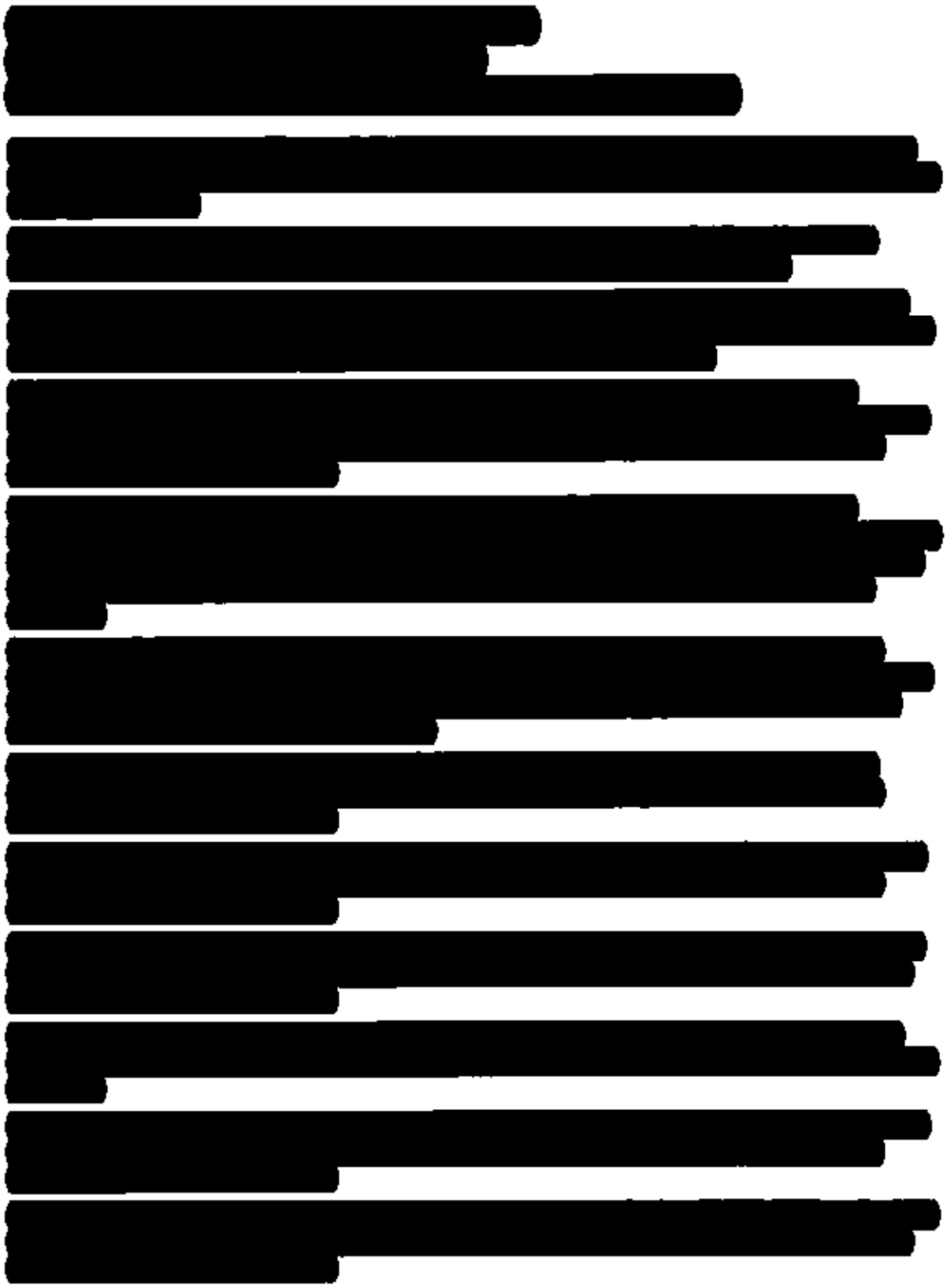

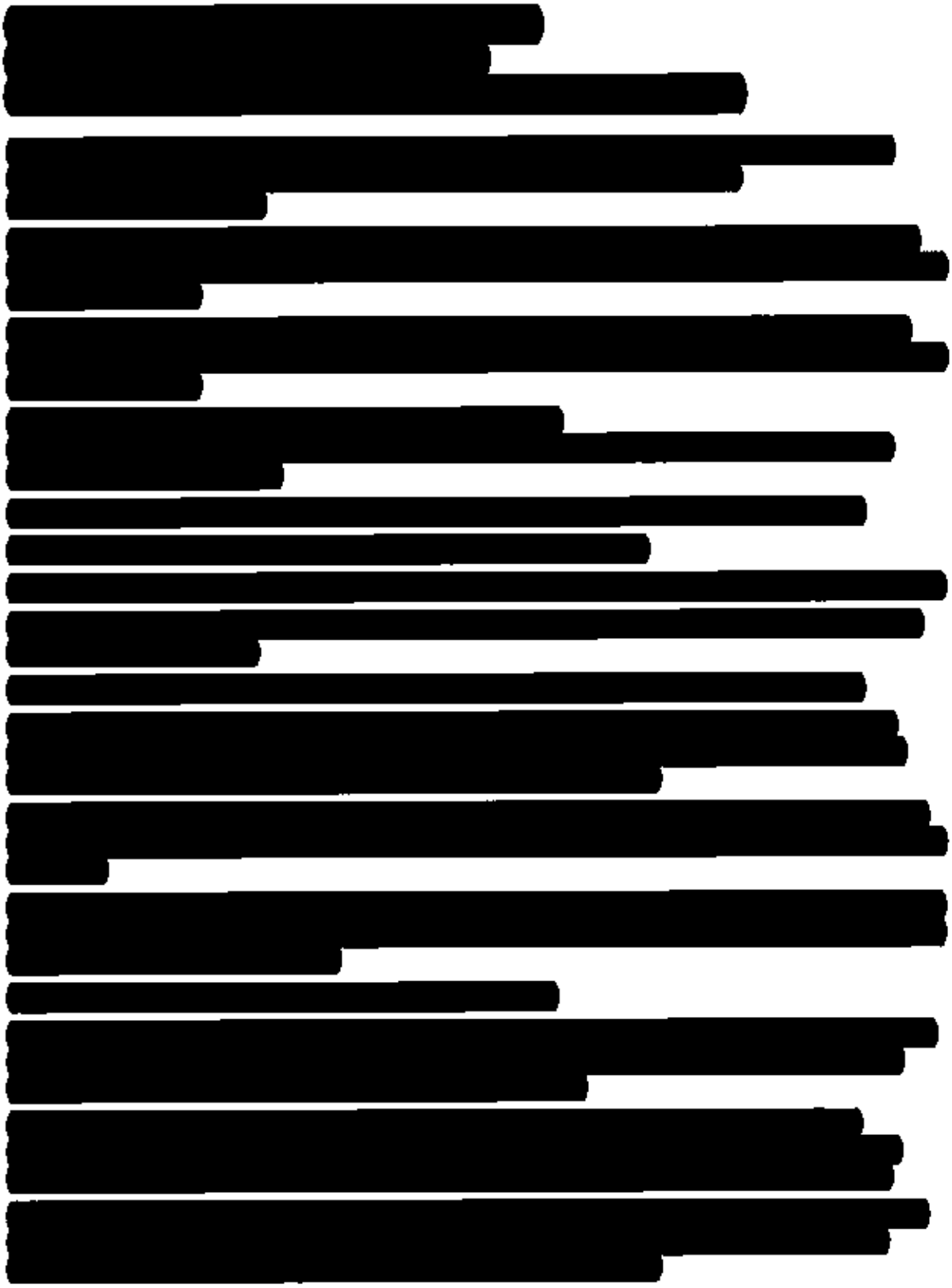

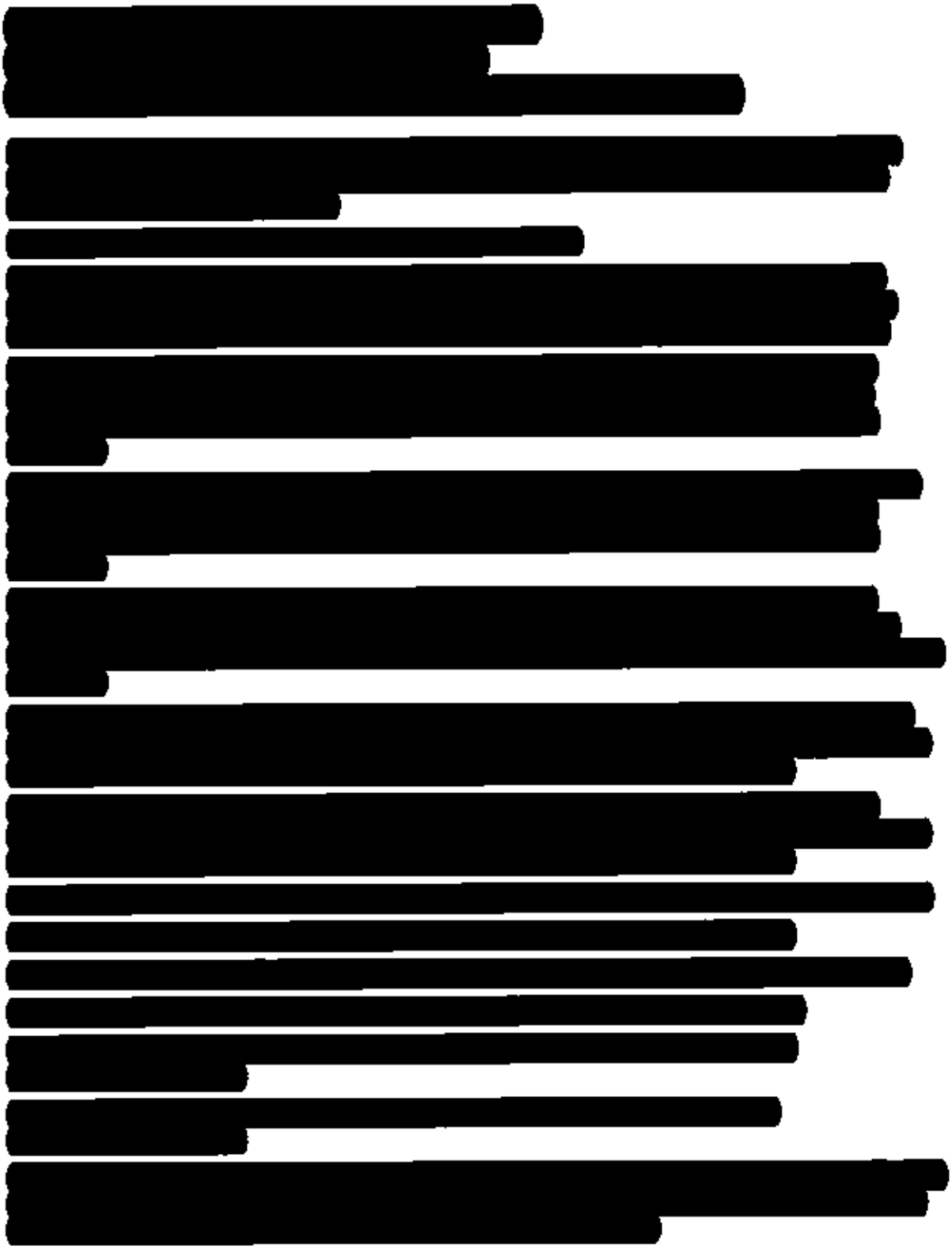

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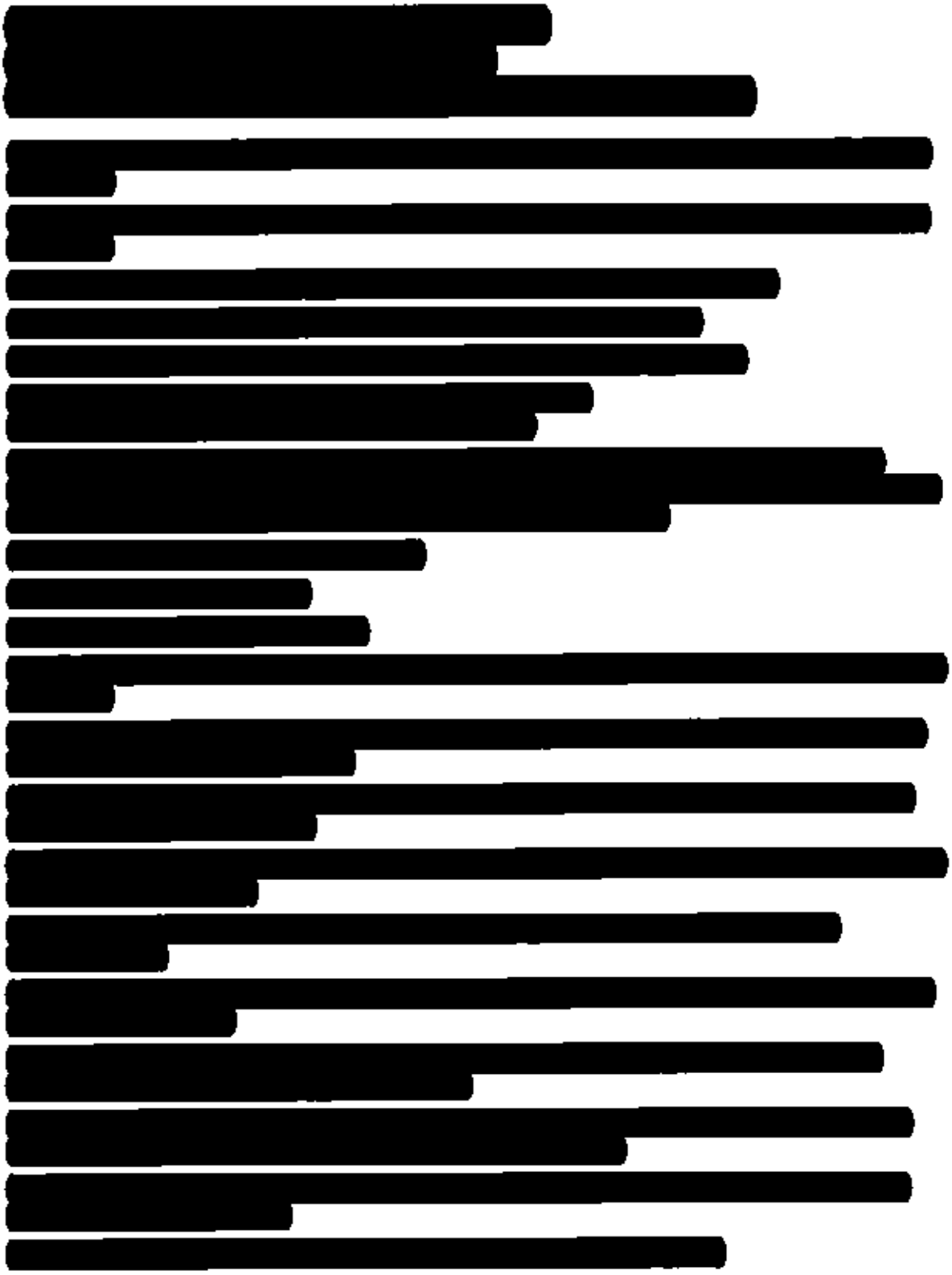

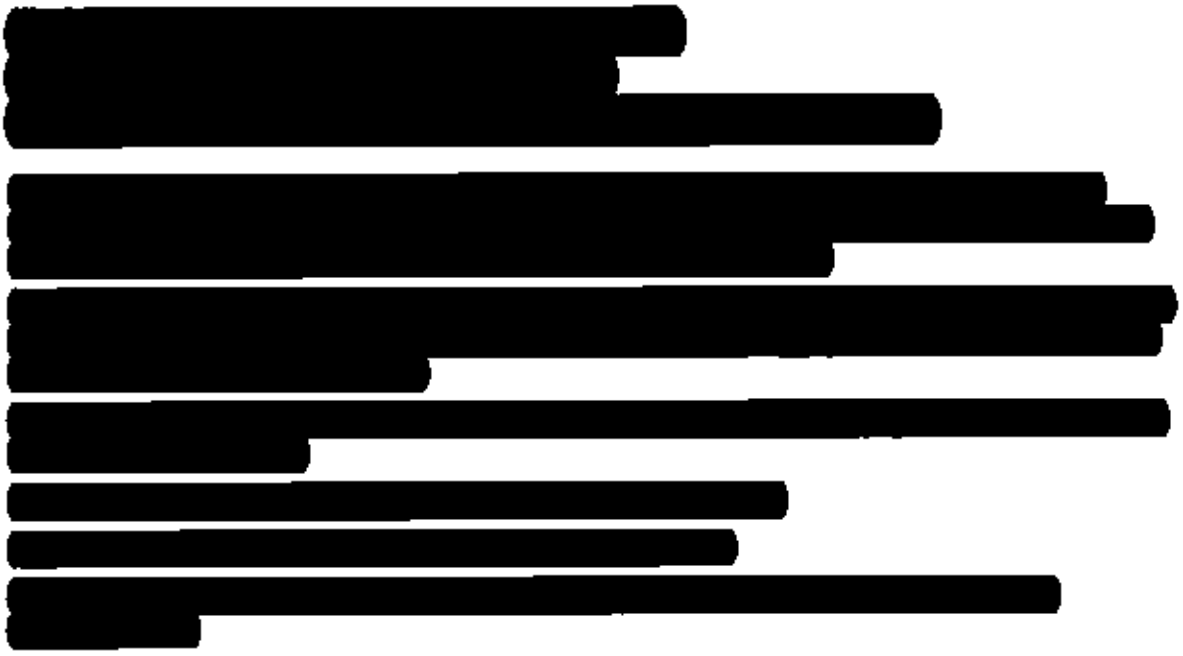

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EXHIBIT 1

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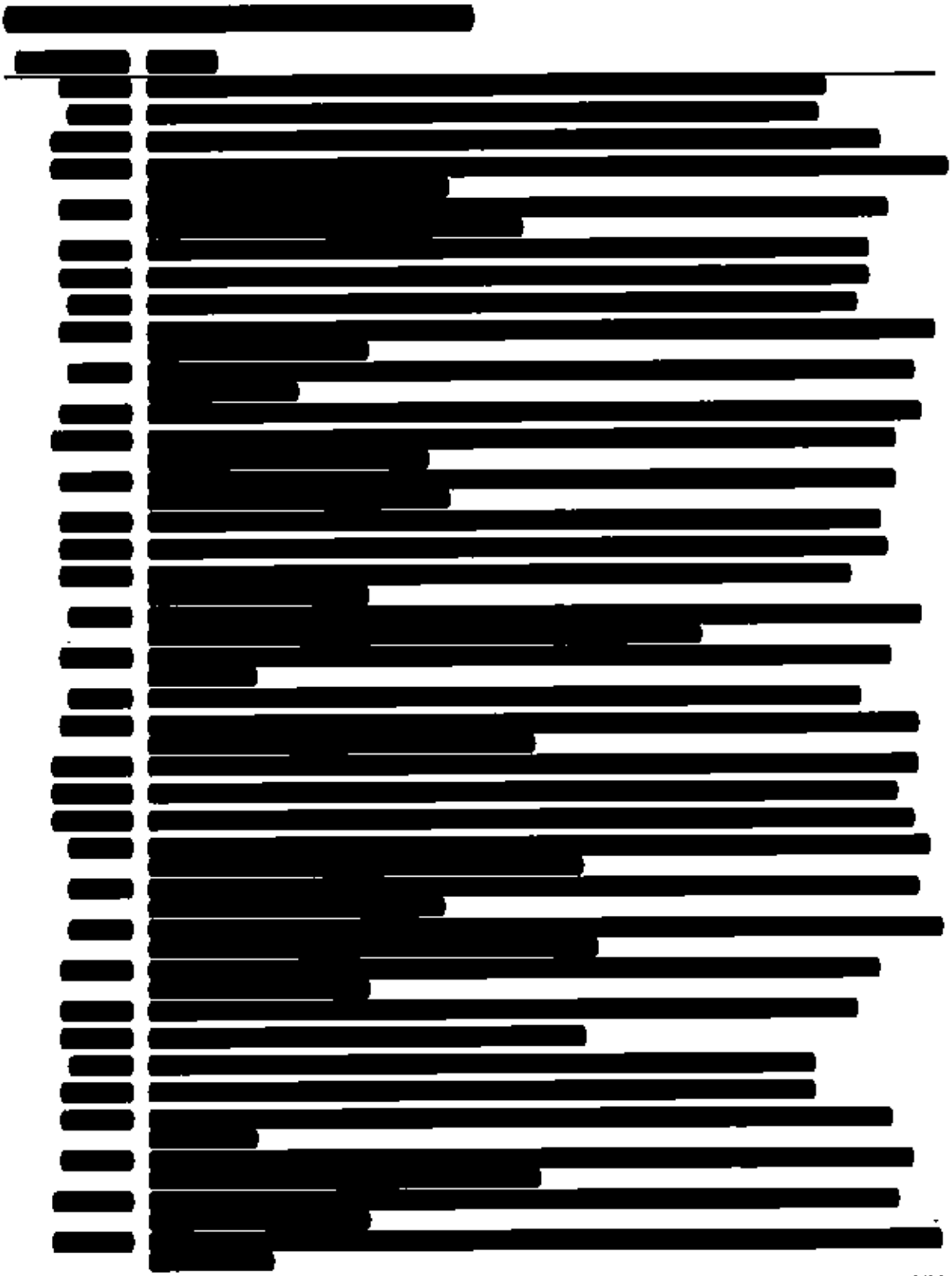

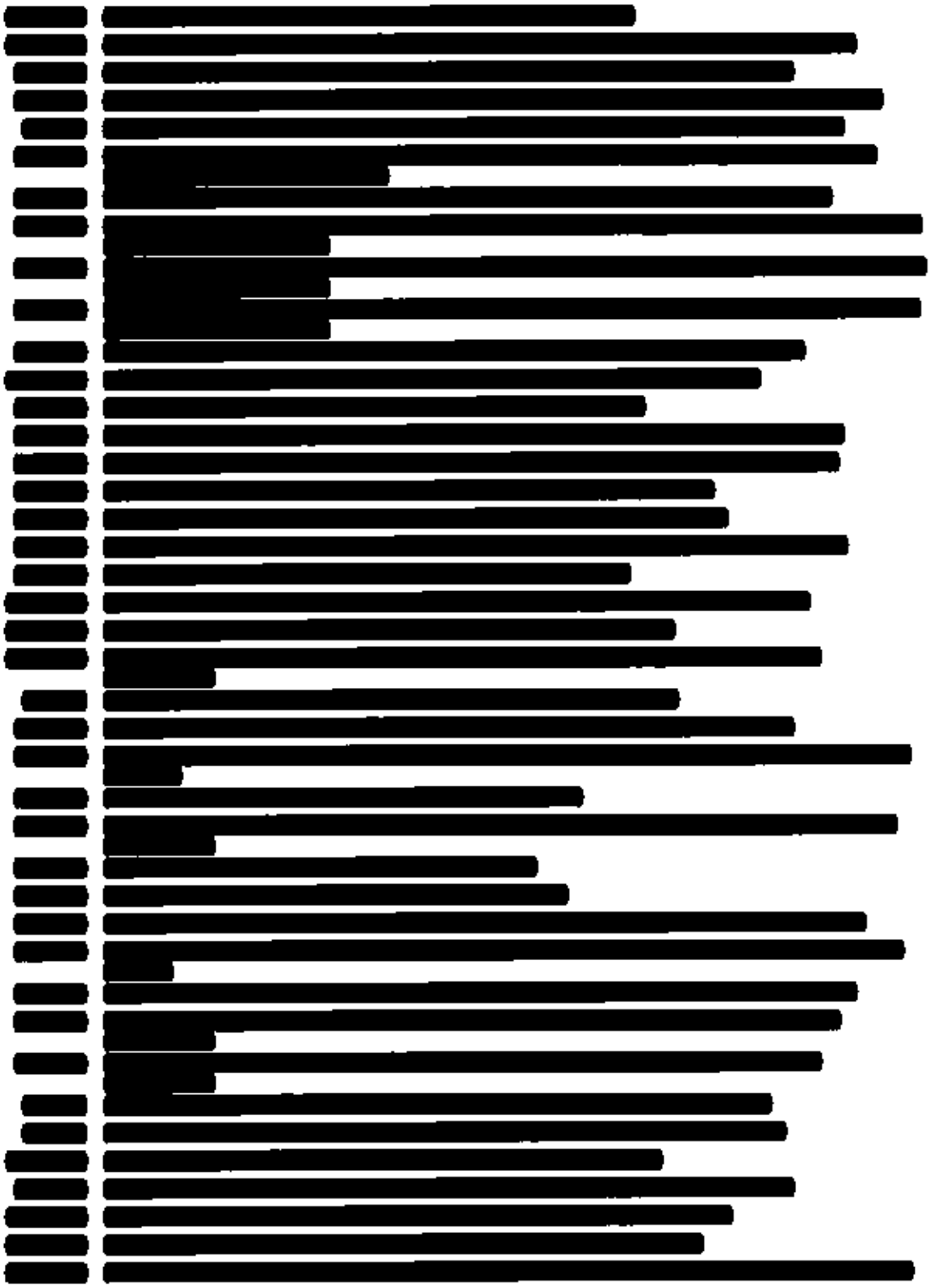

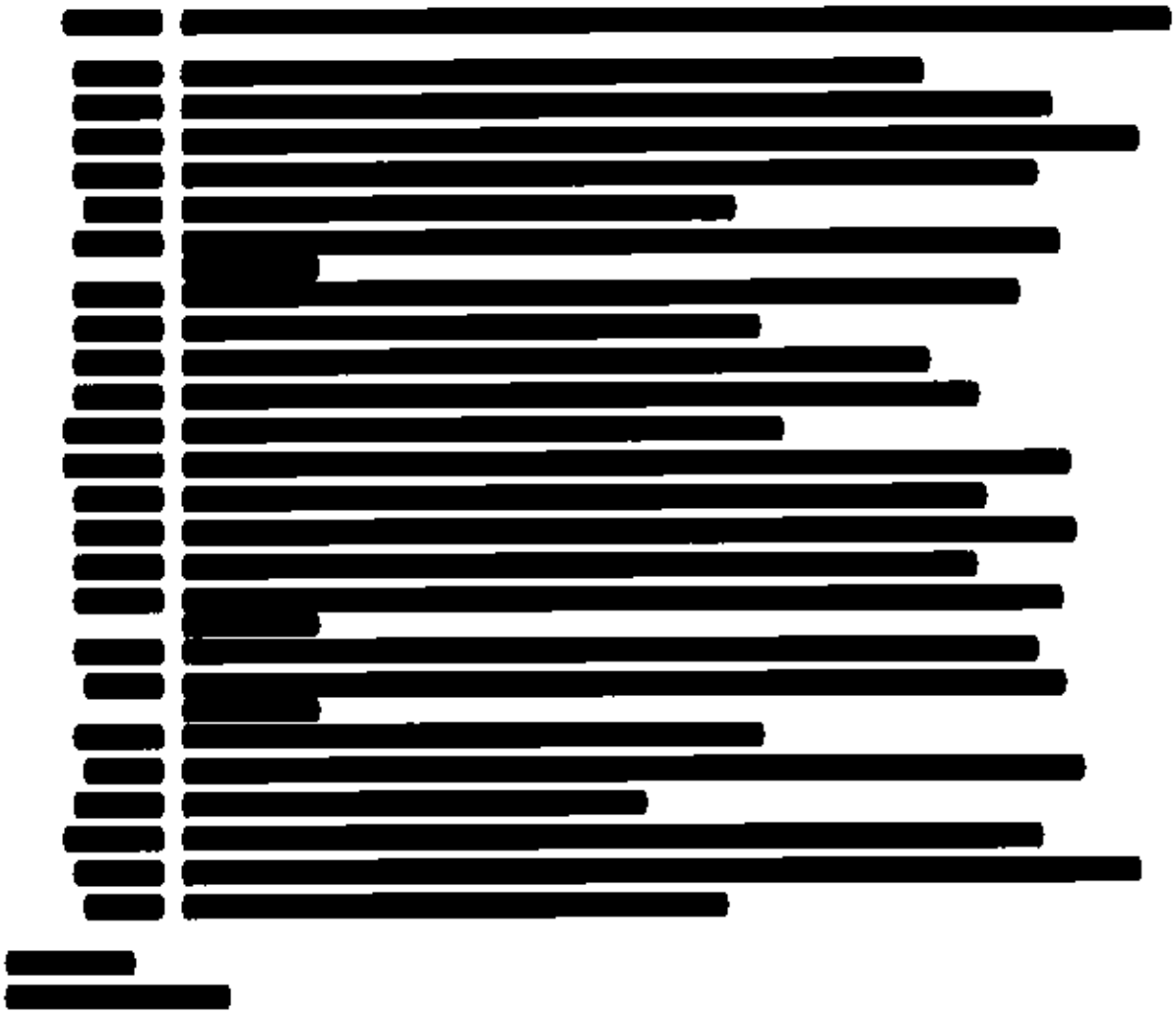

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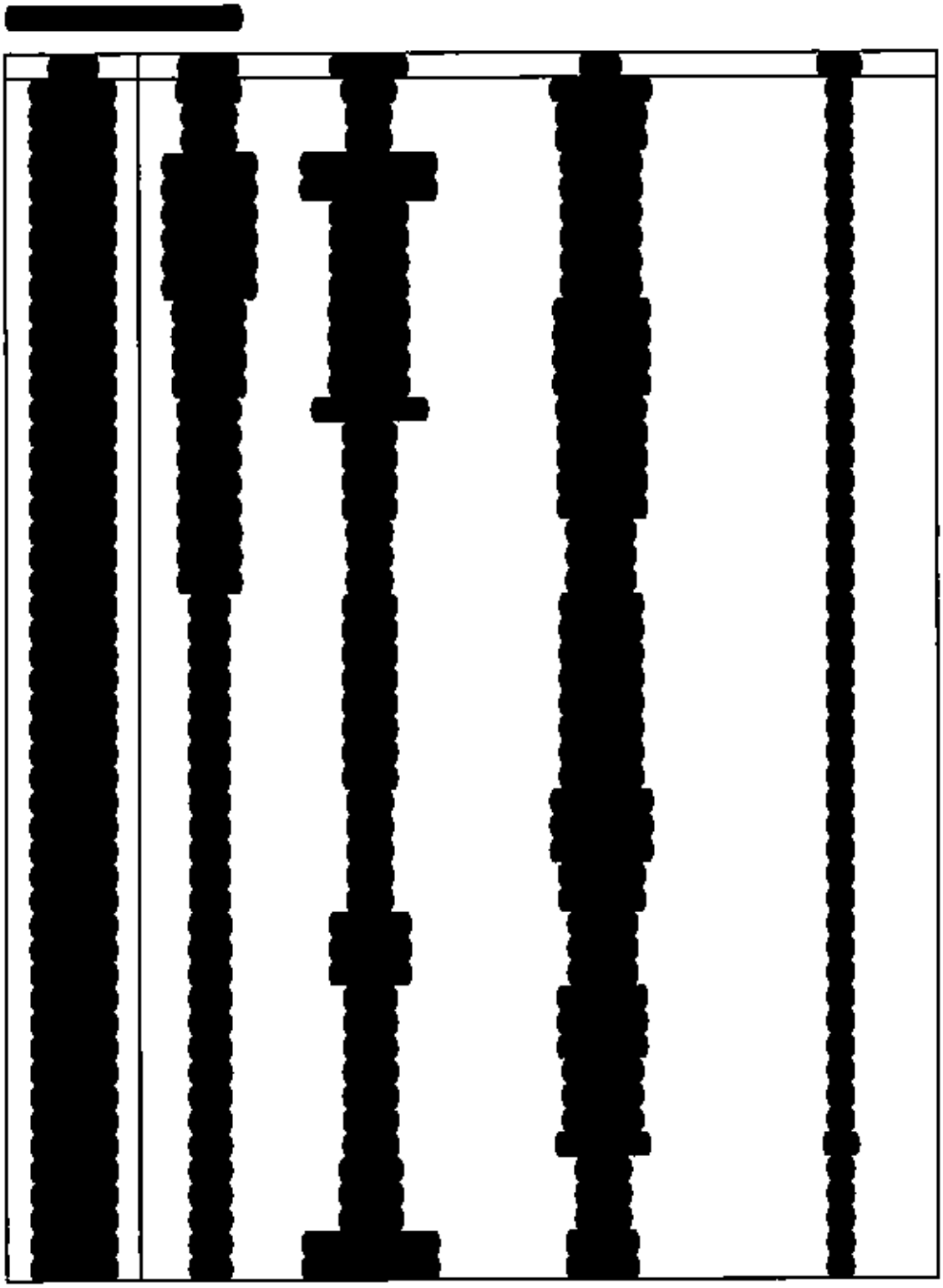

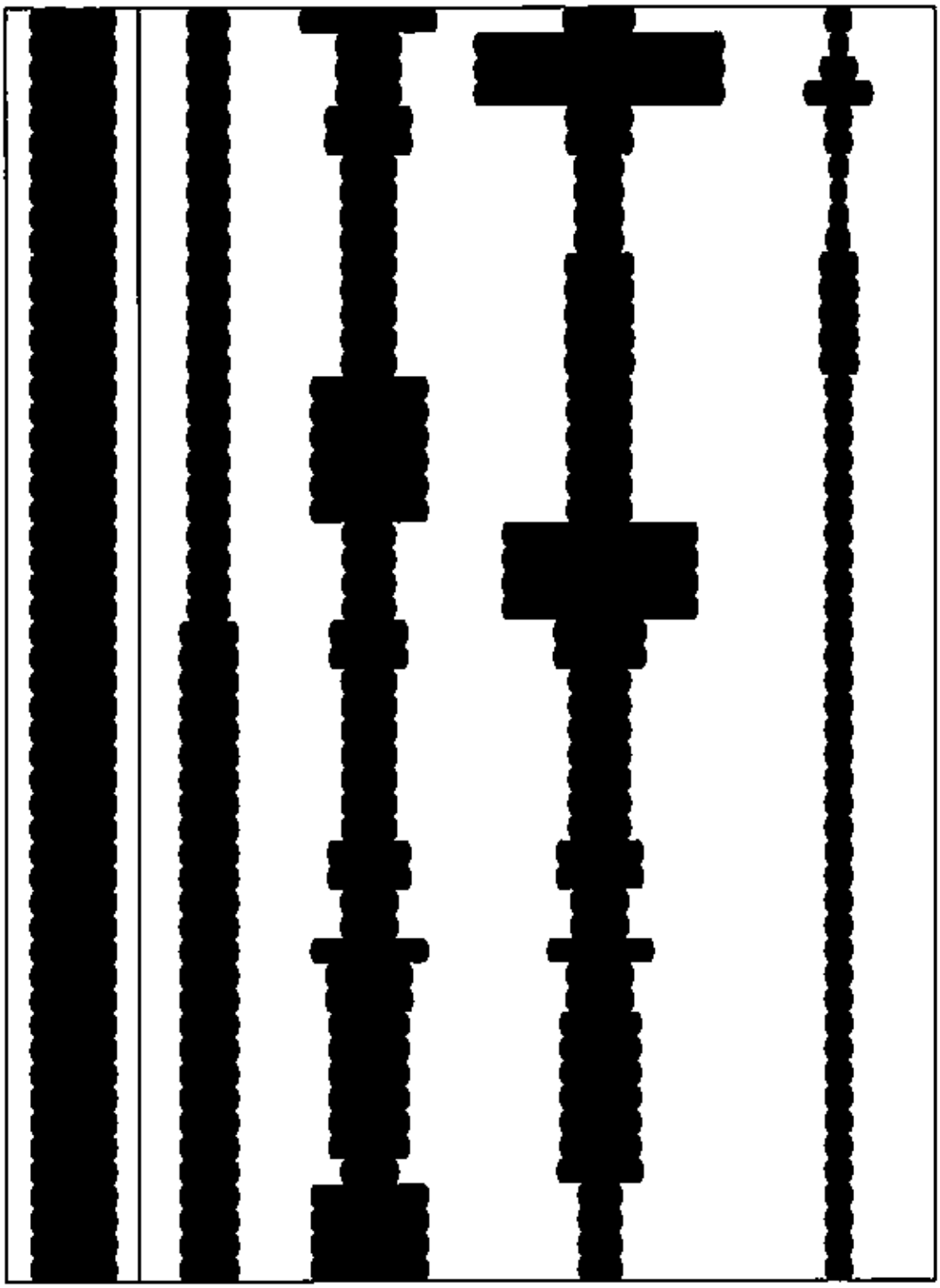

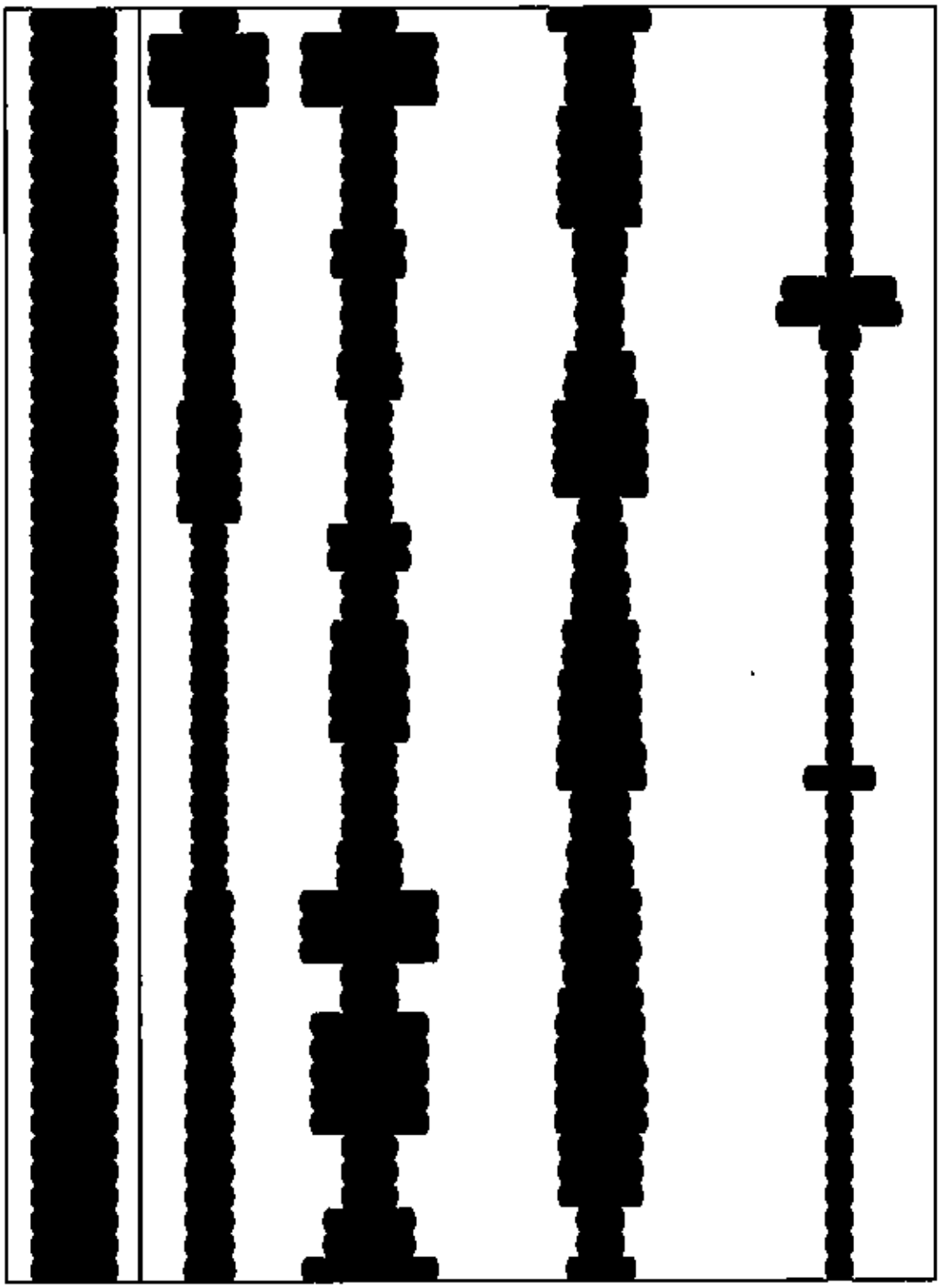

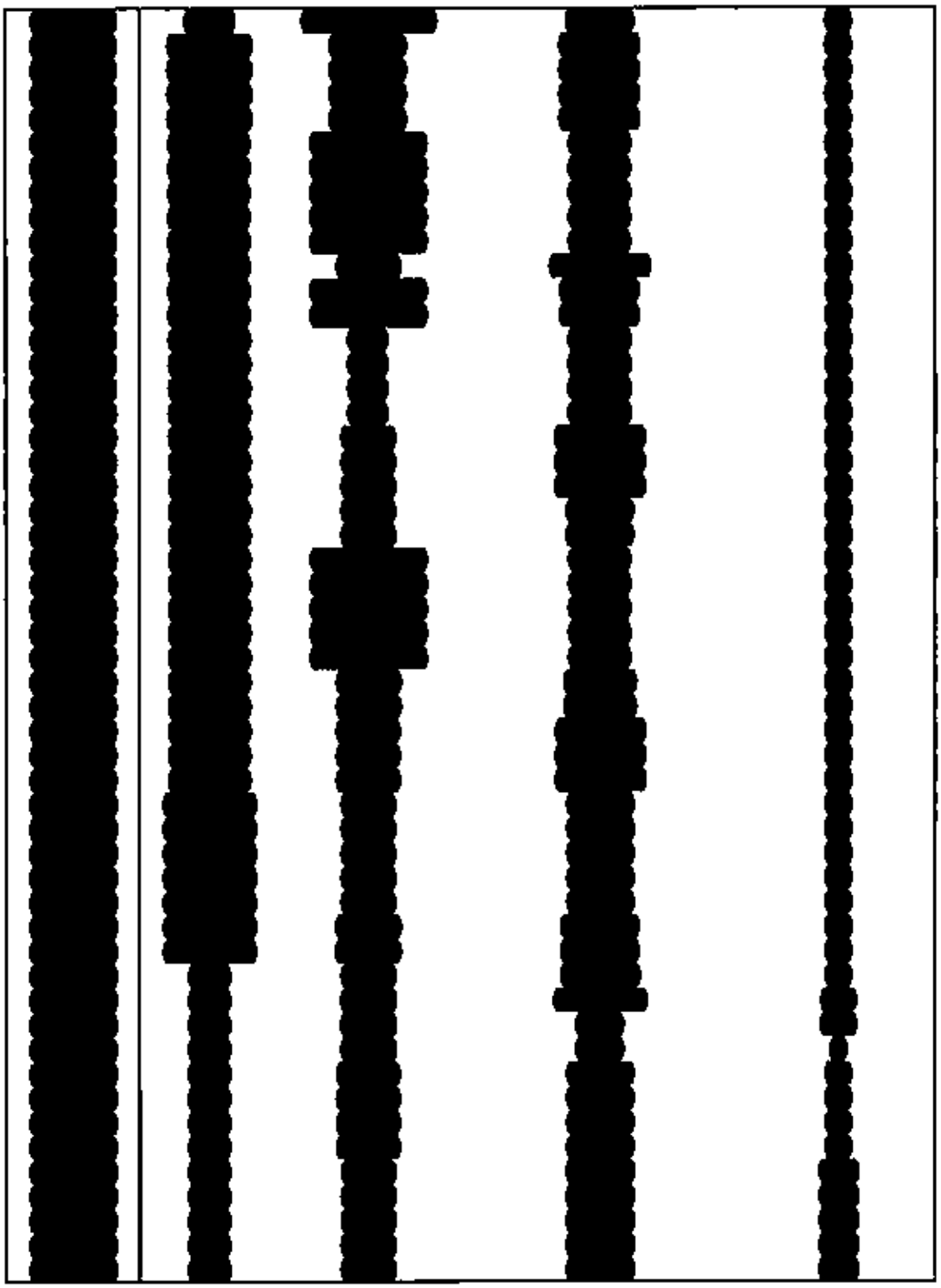

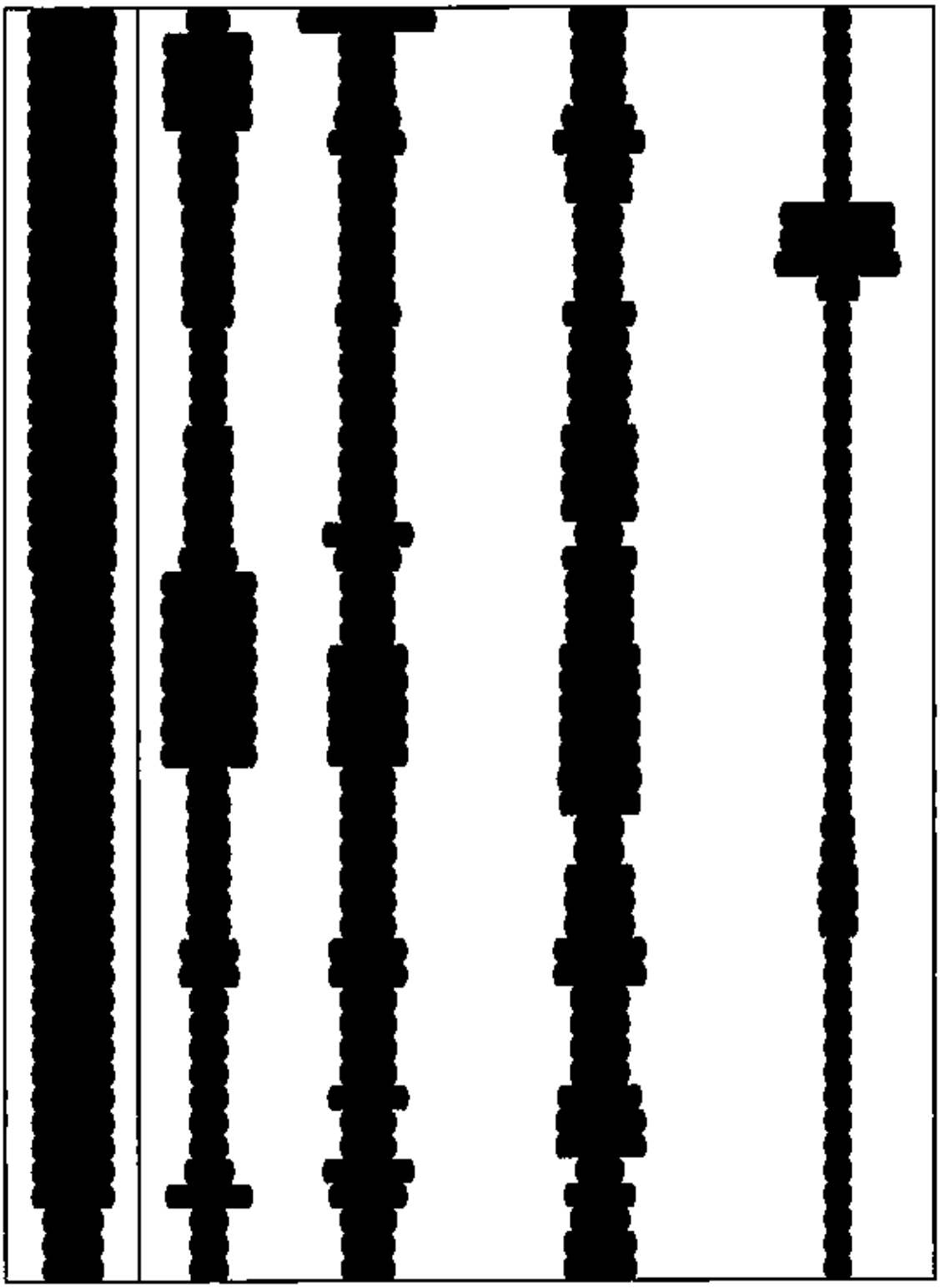

EXHIBITS 5-10

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CRT Distribution Diagram

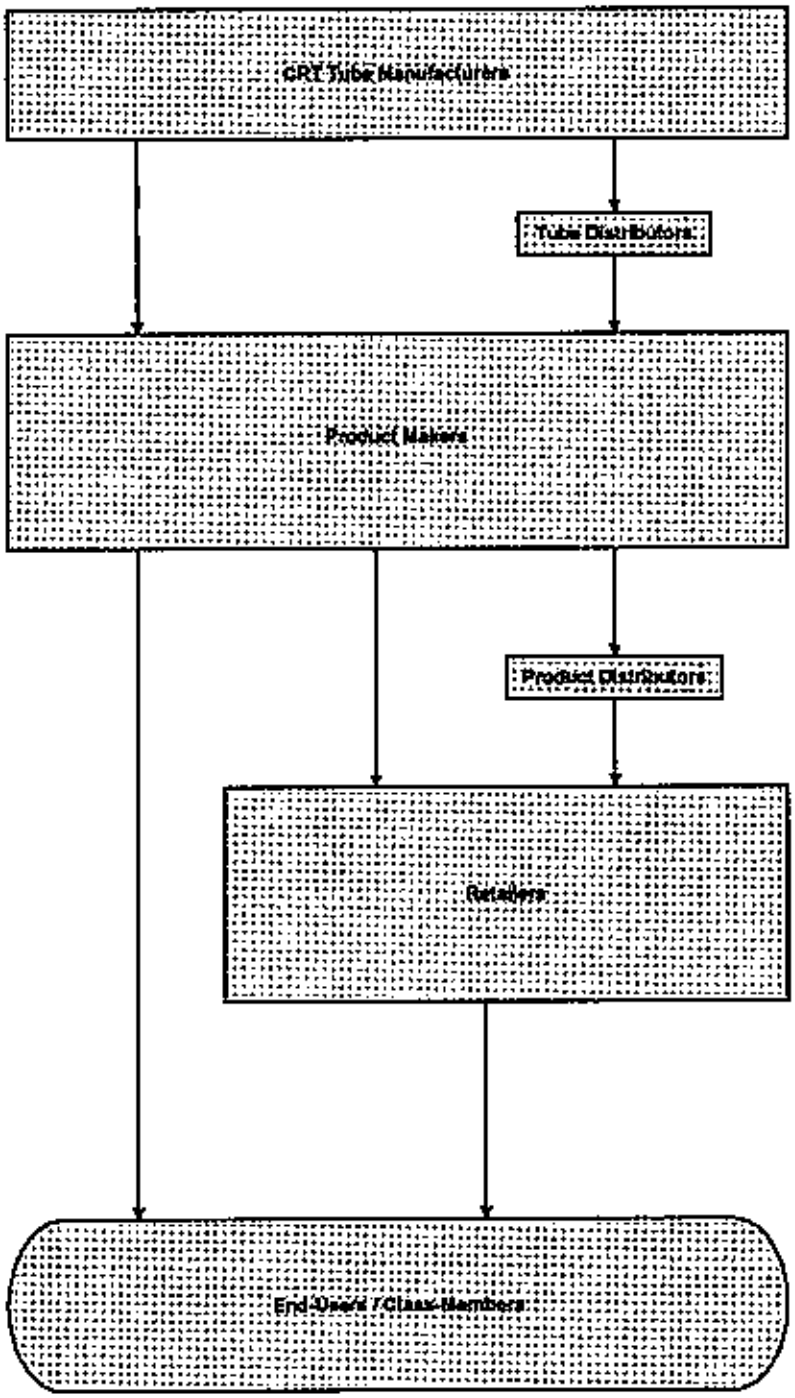

Exhibit 11

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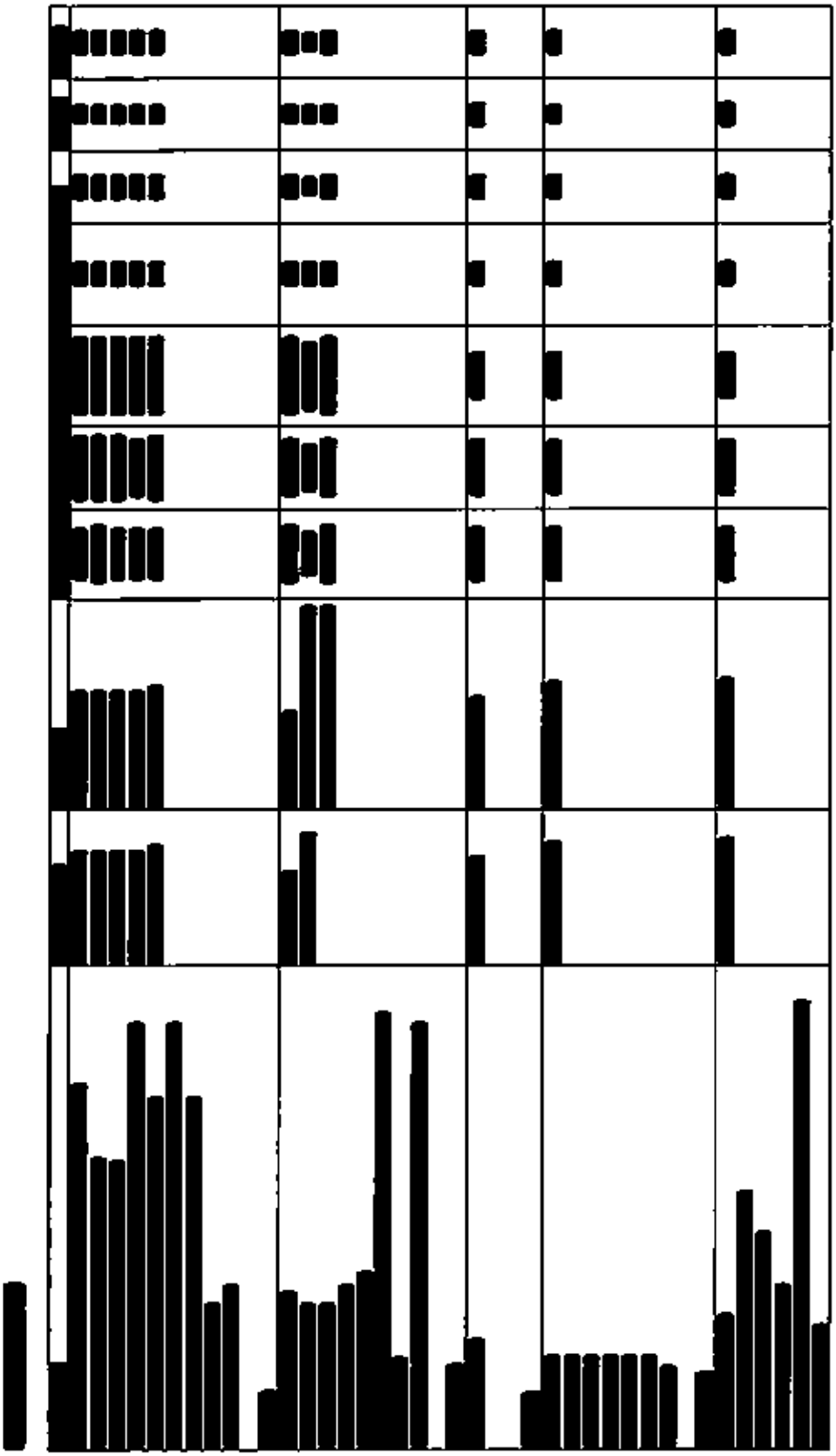

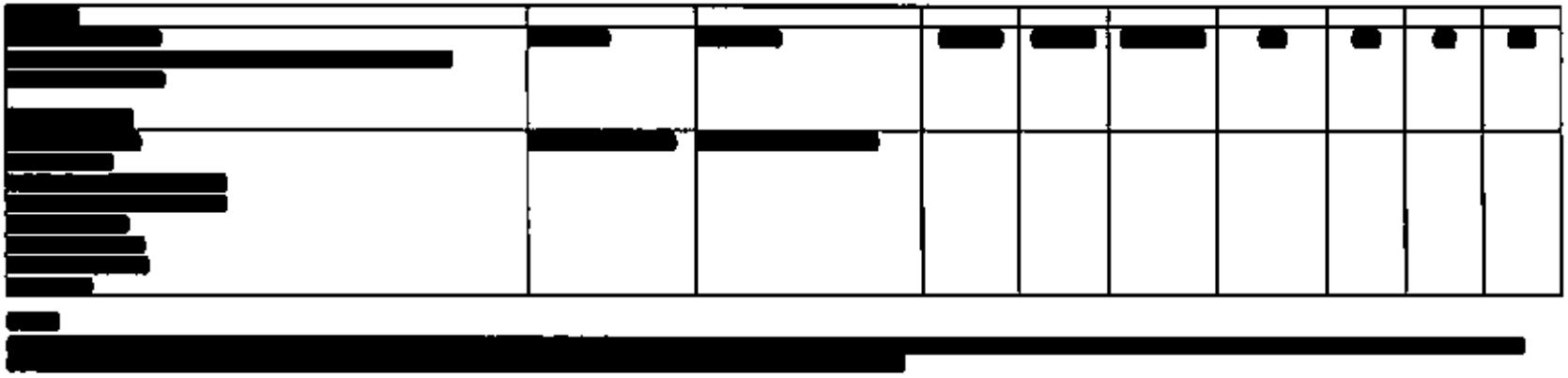

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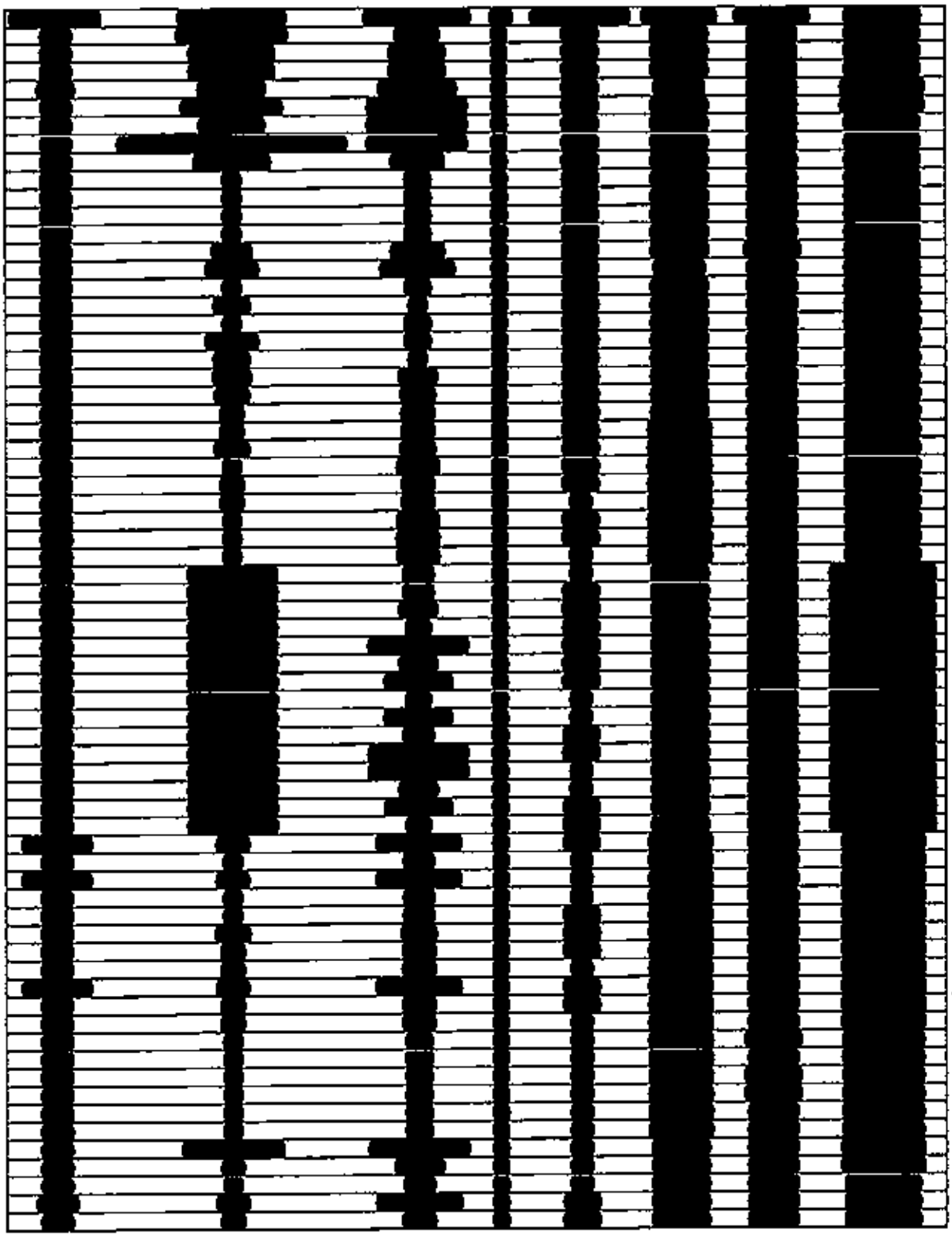

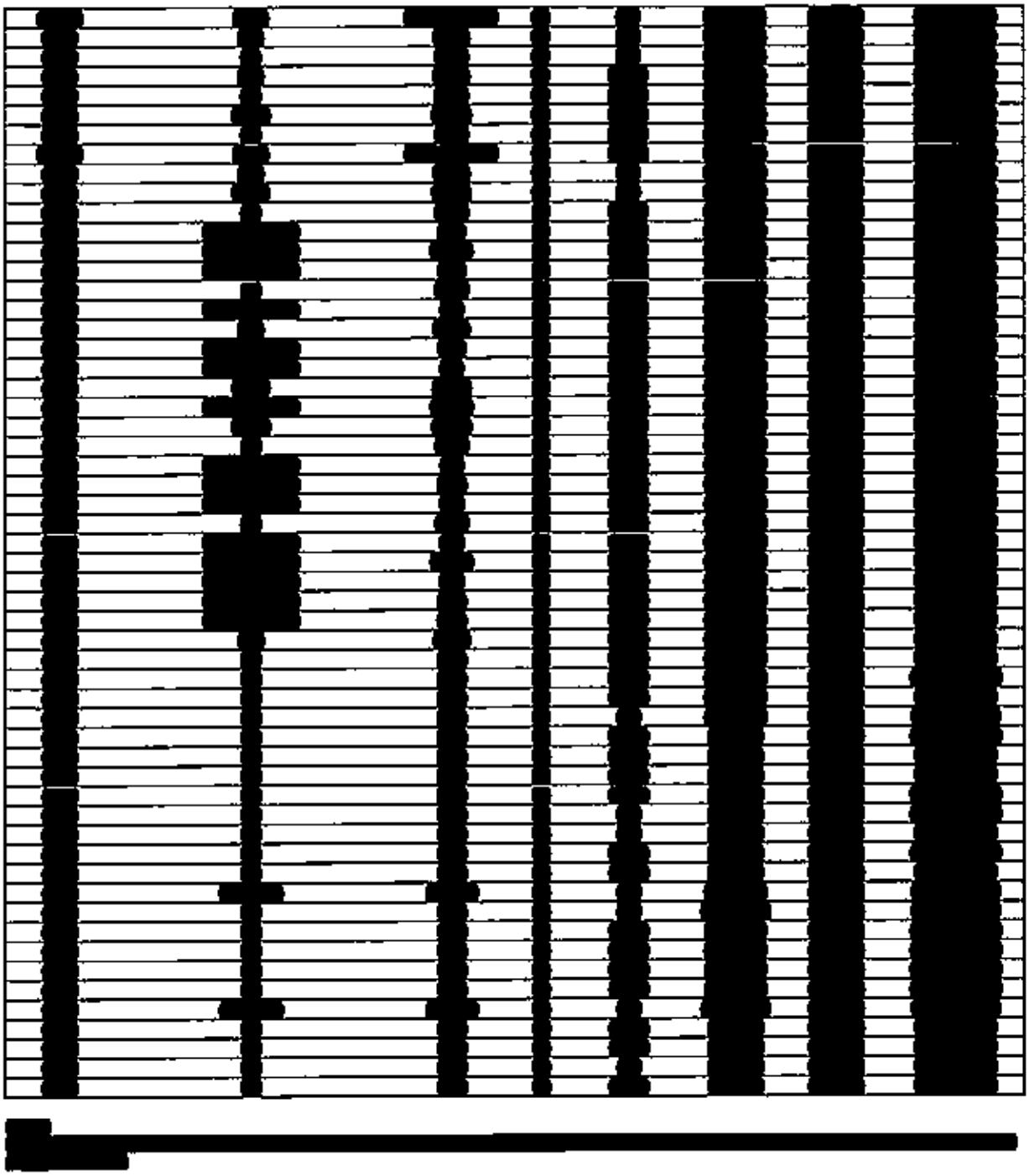

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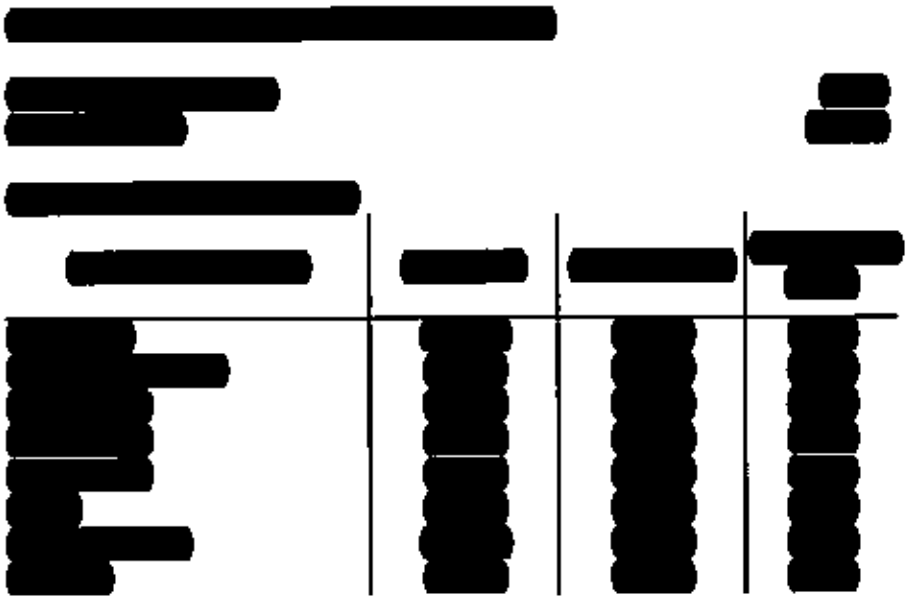

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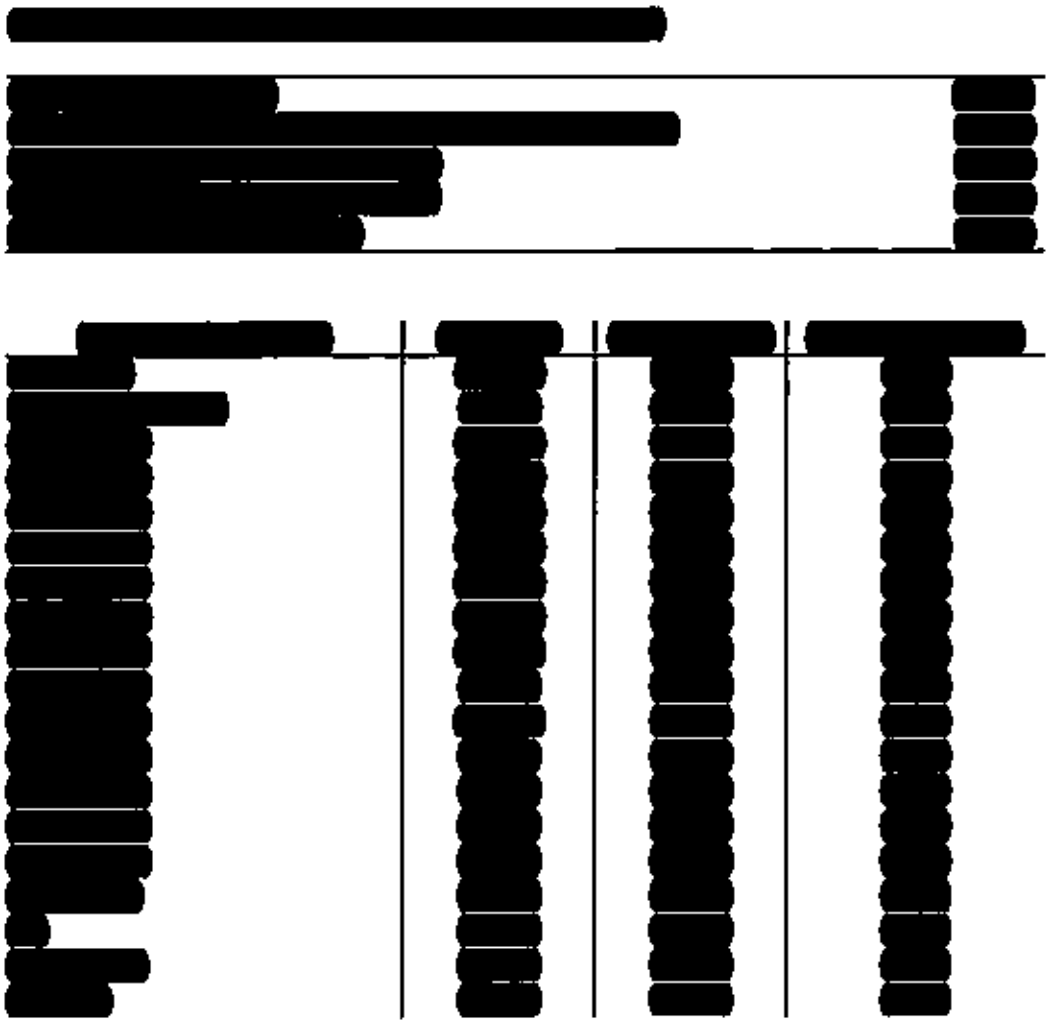

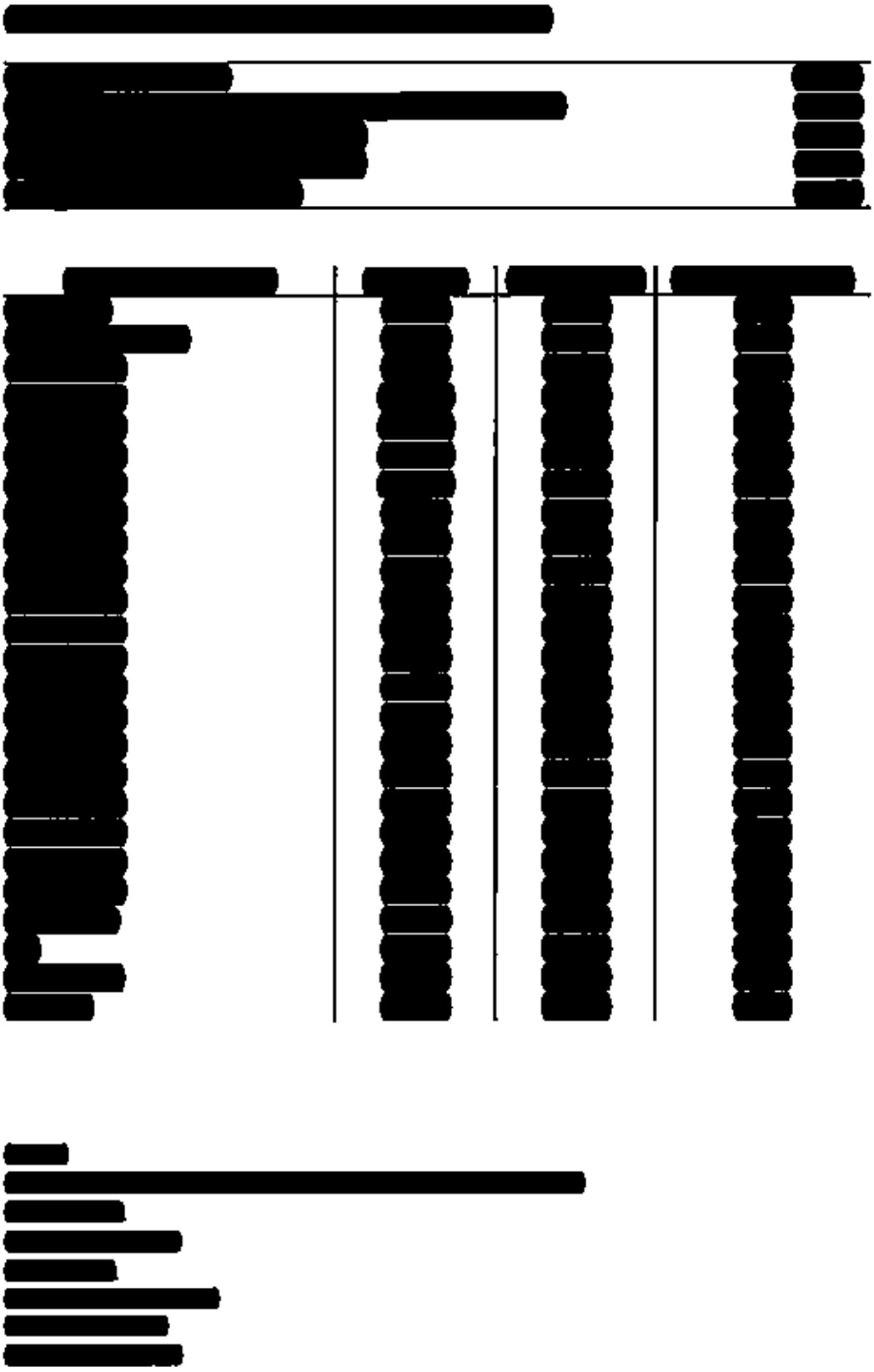

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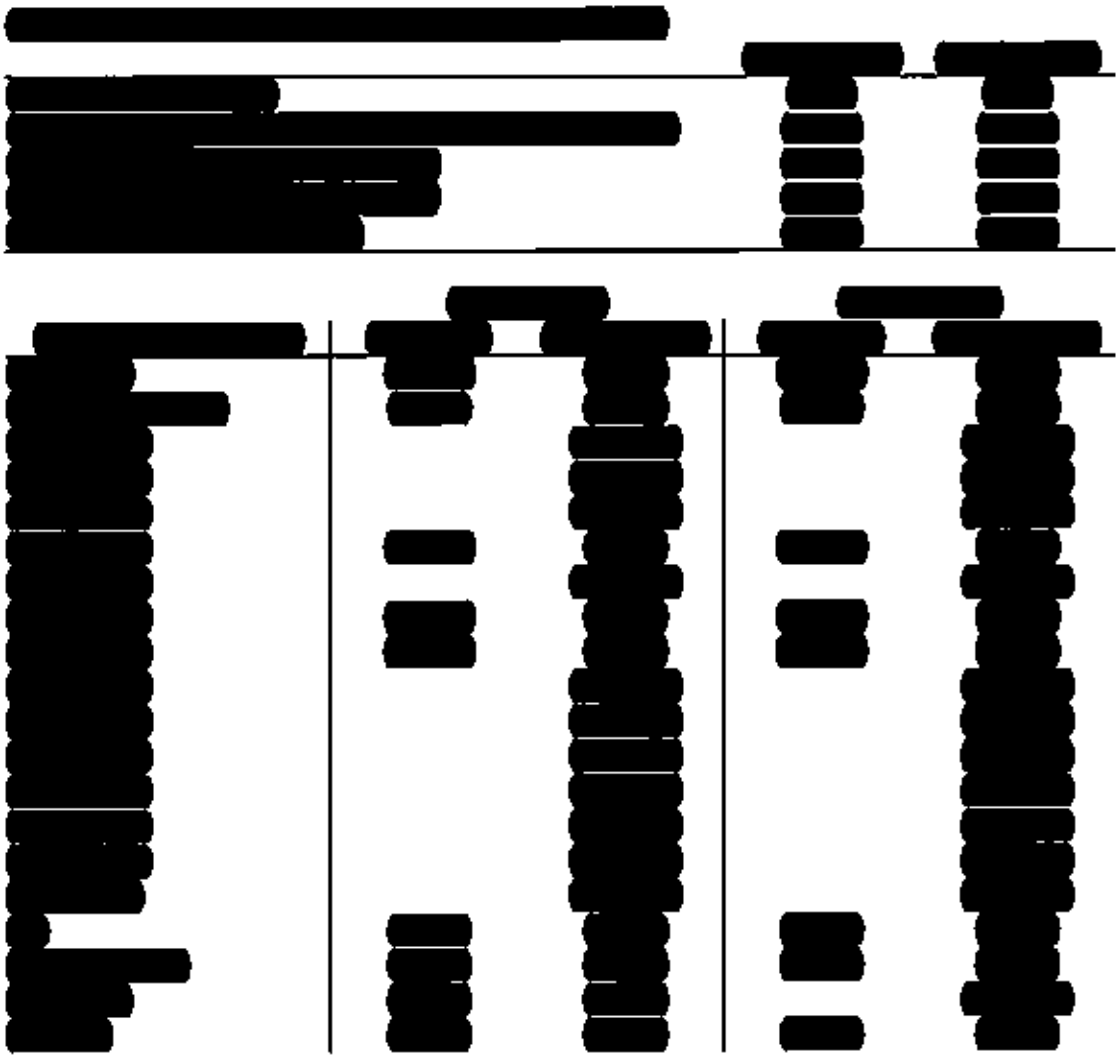

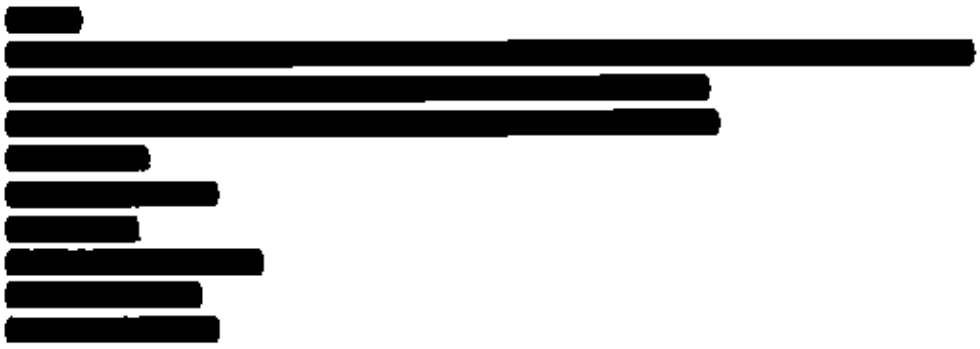

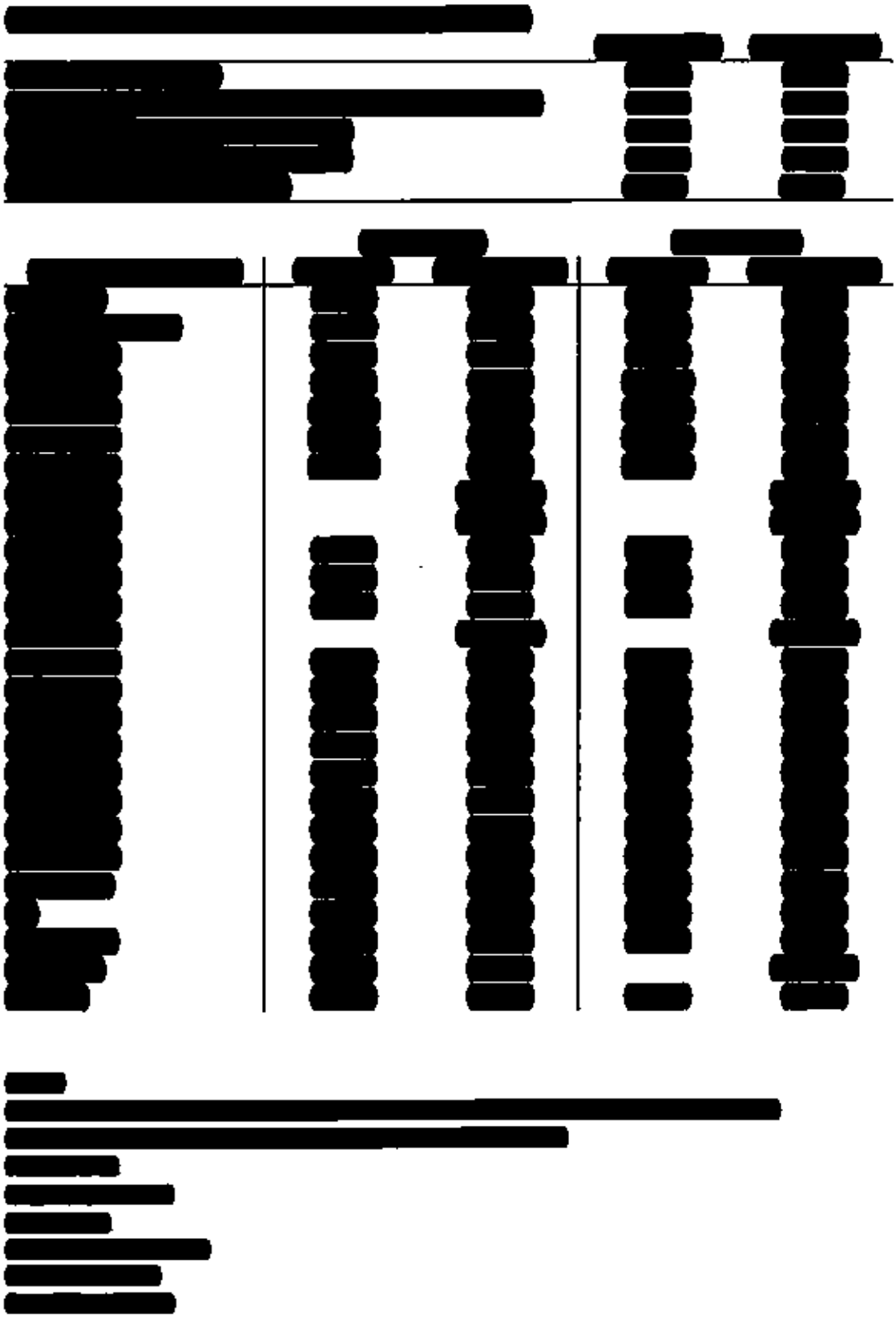

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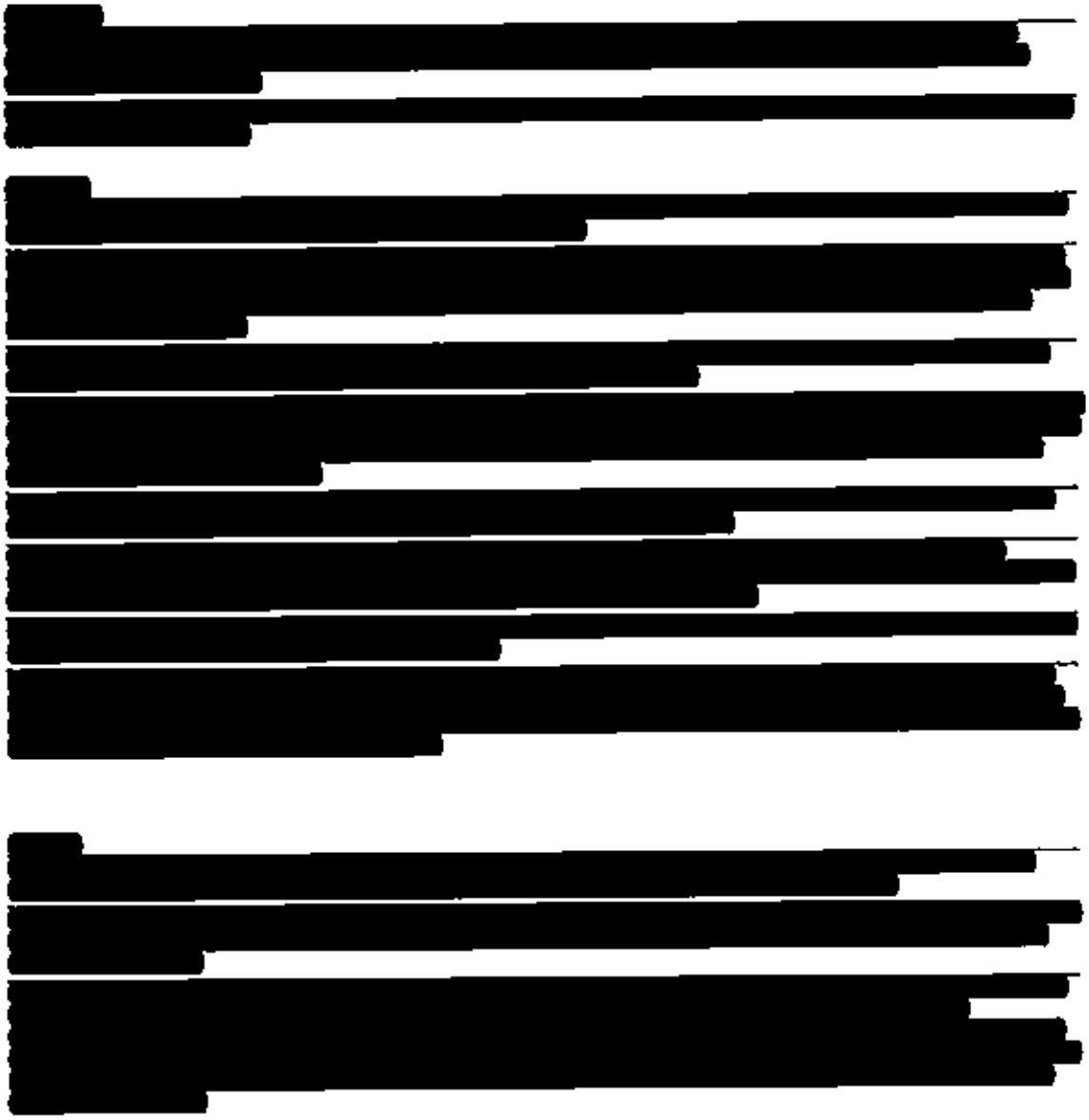

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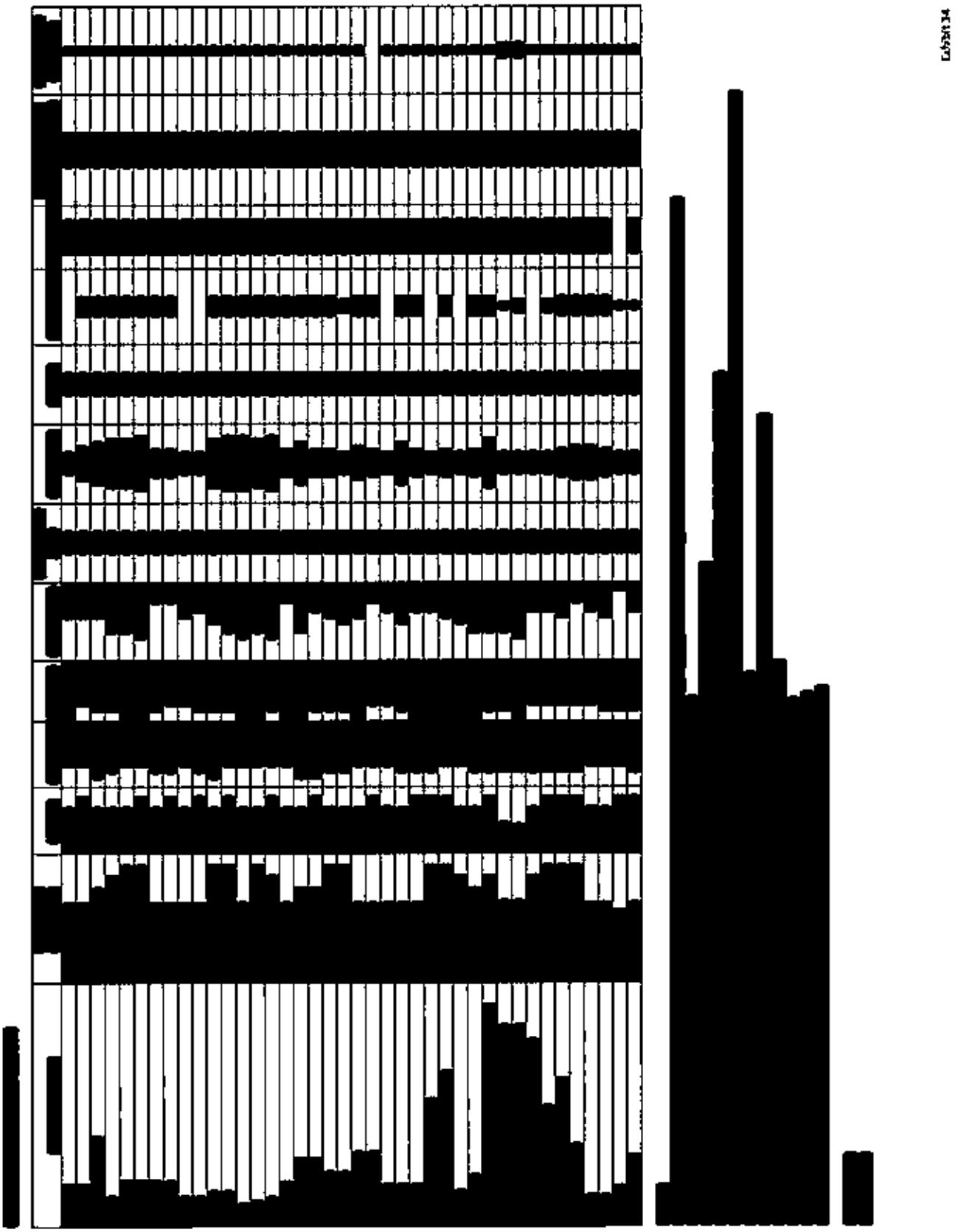

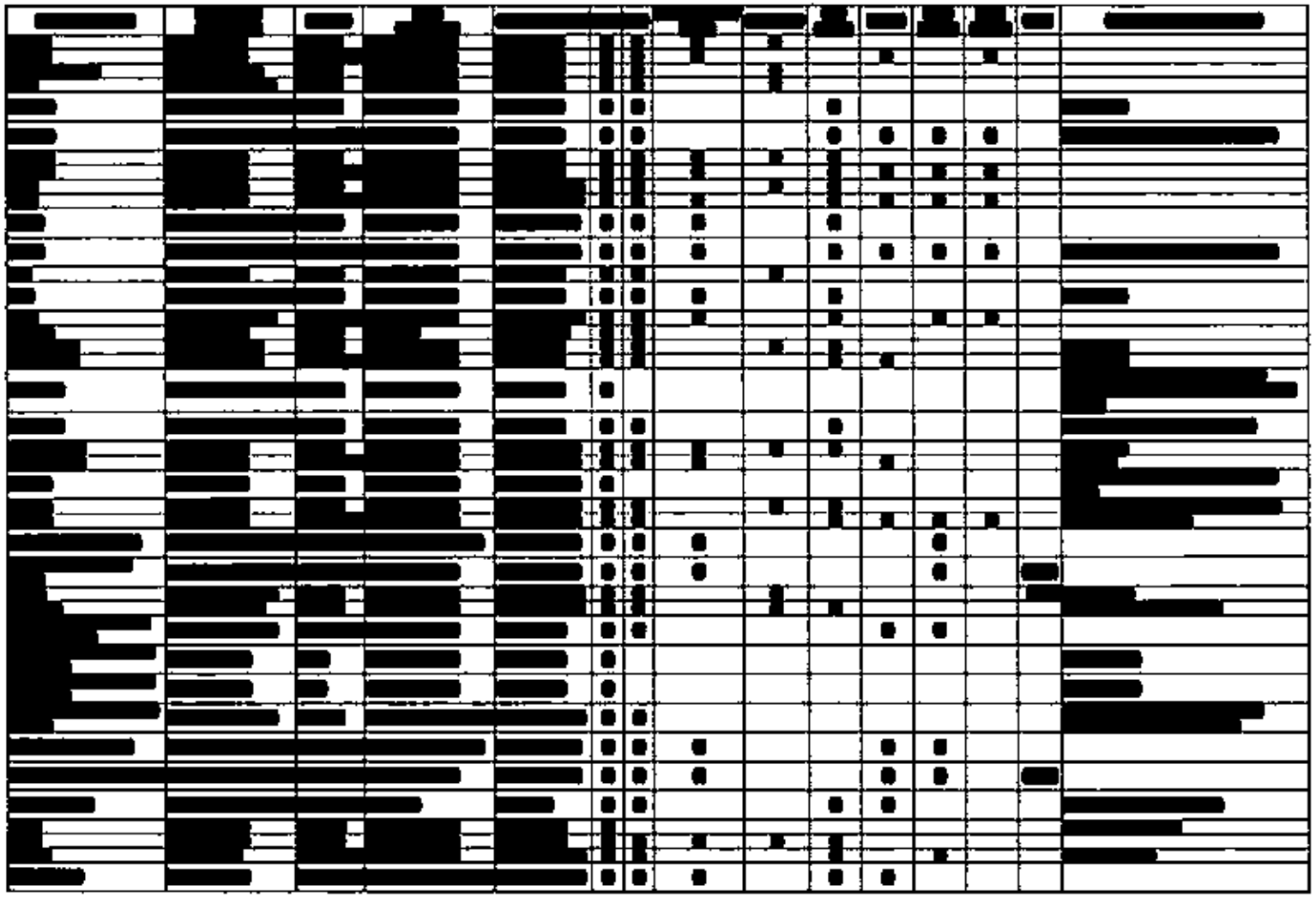

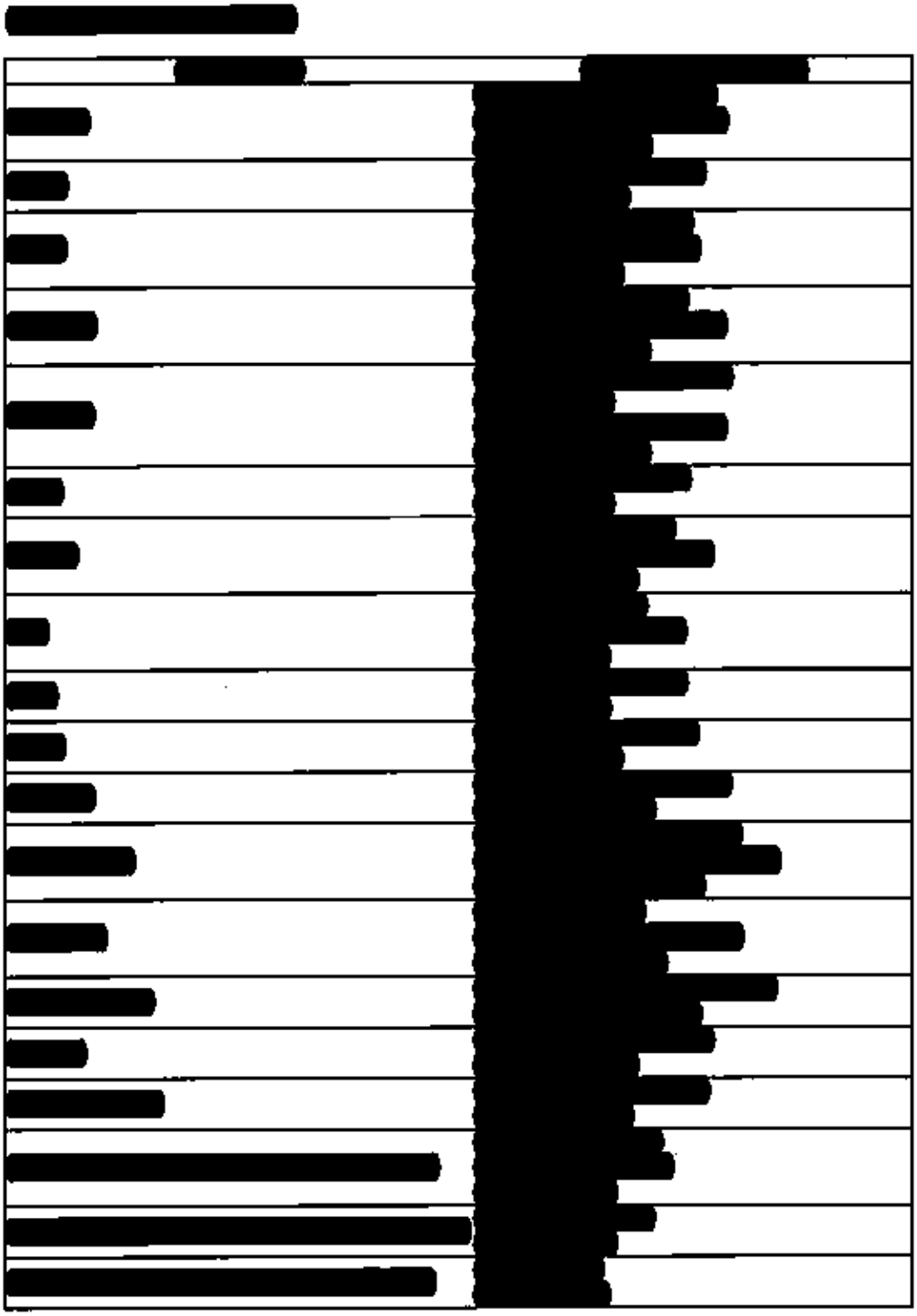

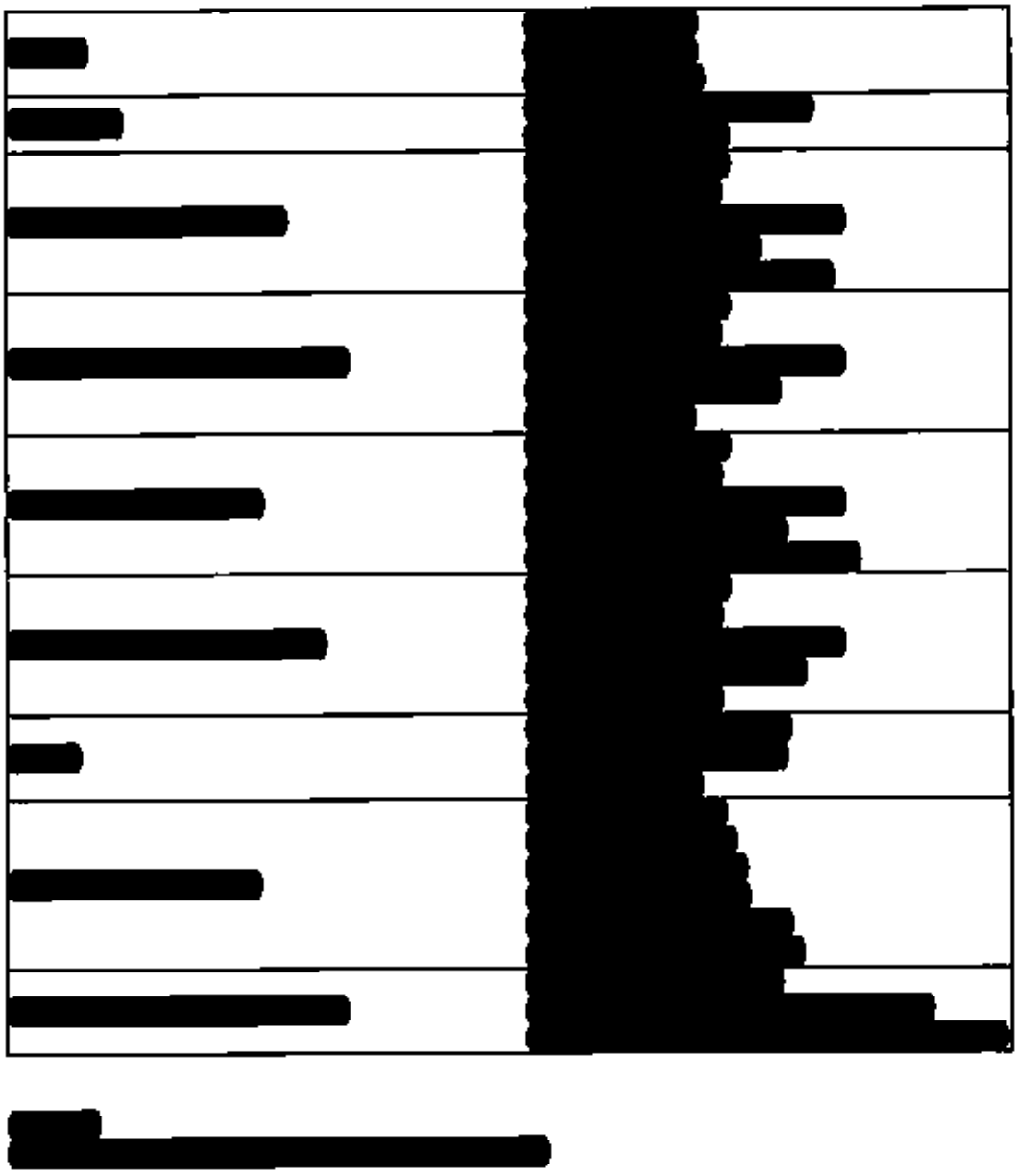

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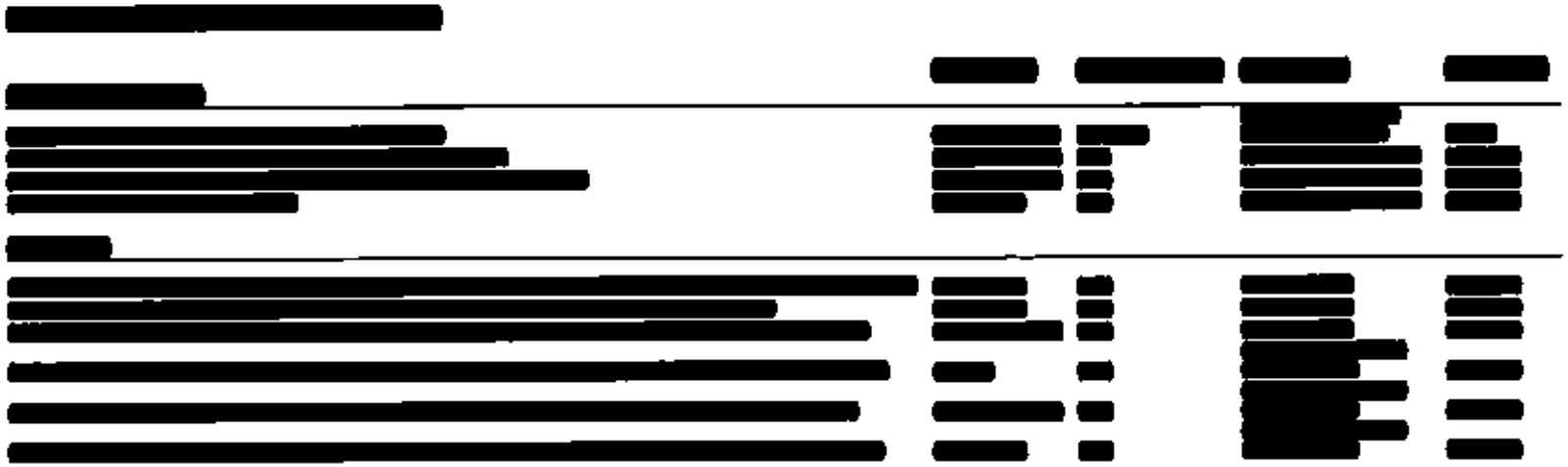

Exhibit 44

General Data Sources

	Source Files
Daily Exchange Rates	
Japanese Yen to U.S. Dollar:	
Board of Governors of the Federal Reserve System, 30 March 2012, Daily Japan / U.S. Foreign Exchange Rate 1971-01-04 to 2012-03-02, http://research.stlouisfed.org/fred2/series/DEXJPUS?rid=94, accessed 09 March 2012	exchange_rates_load_daily.do
JPY to USD Exchange Rates to 20120302.txt	
South Korean Won to U.S. Dollar:	
Board of Governors of the Federal Reserve System, 02 March 2012, Daily South Korea / U.S. Foreign Exchange Rate 1981-04-13 to 2012-03-02, http://research.stlouisfed.org/fred2/series/DEXKOUS?rid=94, accessed 09 March 2012.	exchange_rates_load_daily.do
KRW to USD Exchange Rates to 20120302.txt	
Malaysian Ringgit to U.S. Dollar:	
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